FOUNDRY TRADE JOURNAL

Established 1902

Vol. 96 Thursday, April 22, 1954 No. 1964

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PUBLISHED WEEKLY: Single Copy, 9d. By Post 11d. Annual Subscription, Home 40s. Abroad 45s. (Prepaid).
49 Wellington Street, London, W.C.2. 'Phone: Temple Bar 3951 (Private Branch Exchange) Grams: "Zacatecas, Rand, London"

More Foundry Co-operative Organizations

Though some two months ago we wrote in this column an article congratulating the master patternmakers on the foundation of an association to handle their business requirements, it has needed a further meeting for the body to become officially inaugurated under the title "National Society of Master Patternmakers." There are, so far, between 30 and 40 founder members, a number which will be increased at a second meeting to be held in London. The first president is Mr. B. Levy, the chairman of the London branch of the Institute of British Foundrymen. It is an honour he well merits, as no one has done more for the creation of the Society. The Birmingham meeting made what undoubtedly will be a popular gesture, by according a much reduced fee for concerns employing fewer than five craftsmen. Historically, it can be shown that some of the greatest firms in British industry had similar small beginnings and the prospects for these concerns—providing they keep abreast of the times—is indeed bright.

It is appropriate that the "Society" should be formed at this juncture, as it is at the inception of a period when the master patternmaker is assuming much greater responsibility in the production of castings. This is due partly to the fact that, except for the very largest foundry concerns, the high capital expenditure necessary for the equipment of a modern patternshop, would not be economic for the limited usage it would be accorded by the medium-size foundry. Moreover, a patternshop working for many concerns is less likely to become stereotyped than one attached to a particular foundry and thereby the master shop is capable of disseminating in a practical manner many sound techniques. In this matter, as is the case with so many other manufacturing activities, this country is but following the lead given by America. The new importance of patternmaking warrants, and indeed now has resulted in, a body capable of representing the trade's desires in directions wherein such an authority can be most useful. Because they had previously no organized mouthpiece, patternmakers did not participate in the creation of a British Standard specification for the colour marking of patterns, but we now hope that the membership of the new Society will do their best to see the colouring provisions are propagated. Now that master patternmakers conduct a nation-wide business, and some of them export their products as well, there is the greater need for them to conform to British Standard specifications.

Last week, a second new co-operative body was formed, designed to cover the requirement of firms engaged in shell-moulding activities. It is to be known as the Shell-moulding Association. Following founding tradition, this, too, was born in Birmingham. Master patternmakers have an interest in this also, as great precision is needed from the patterns the process uses. The prospects for both bodies are indeed bright, and to them we extend greetings and good wishes for future progress.

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FIG. 1.—*Groups at the jubilee meeting and banquet of the Institute of British Foundrymen.*
(For details see foot of facing page.)

I.B.F. Golden Jubilee

Anniversary Celebrated and Fifty Years' Work Reviewed

On Friday, April 9, the fiftieth anniversary of the inaugural meeting in Birmingham of the Institute of British Foundrymen (then, the British Foundrymen's Association) was celebrated in London with fitting ceremonial. A jubilee meeting was held in the afternoon and a banquet in the evening.

JUBILEE MEETING

The jubilee meeting of the Institute was held at the Café Royal, Piccadilly Circus, London, at 2.30 p.m., the president, Mr. E. Longden, being in the chair.

Opening the meeting the president said this was indeed a memorable occasion. They were able to look back and review the activities of men who in the past had been members of the Institute of British Foundrymen and see their impact on the industry generally. They were favoured with the presence of some very distinguished representatives from abroad, including Mr. A. Brizon, president of the International Committee of the Foundry Technical Associations; Mr. Goffart, president of the Belgian Foundrymen's Association; and Mr. F. W. E. Spies, president of the Foundry Technical Association of the Netherlands and a past-president of the International Committee. Mr. Spies, he said, had done much to promote international collaboration in the technical development of the foundry. The Institute's Council considered the jubilee celebrations an appropriate opportunity for the Institute to recognize the value of the work done by him in the sphere of international understanding and they had, therefore, elected him to honorary membership of the Institute of British Foundrymen.

MR. SPIES said he could not express his gratitude because he was so surprised that he did not know what to say, but he regarded it as a very great distinction to be an honorary member of the Institute and he promised members that, as in the past, they should have all the co-operation of which he was capable.

Competition Award

THE PRESIDENT then came to the presentation of the Jubilee Award, saying that members would know that the Council had decided to commemorate the jubilee in one way by having a competition open to men up to 30 years of age. The competition entries had been judged first by branch delegates and branch awards made. From the papers submitted a selection had been made and the final award on a national basis had been given to Mr. Dennis Frederick Bailey for his paper on "Some Aspects of Shell Moulding."*

Presenting the cheque for £25—the national award—to Mr. Bailey, the president said he considered his paper an excellent one. The judges had had the utmost difficulty in arriving at a decision, owing to the high quality of all the papers submitted.

Interesting Souvenir

MR. S. H. RUSSELL, a past-president, remarked that for many years his father had had hanging in his office a group photograph of the 1906 convention held in Middlesbrough. That had disappeared for many years, but had turned up recently. He thought the Institute would like a copy of it because it was a group from which many of the older members could be identified. The photograph had been mounted in a suitable folder and they had succeeded in identifying a number of members and it was to be hoped that someone might succeed in finding others. It gave him great pleasure to hand the photograph over to the Institute.†

THE PRESIDENT, accepting, said he appreciated very much Mr. Russell's gift.

History of the Institute

DR. C. J. DADSWELL, immediate past-president, then introduced the record which had been compiled of the history of the Institute and said that for their secretary, Mr. T. Makemson, as one responsible for much of the work of the Institute and the *making* of its history to accept the invitation to *write* this history of the Institute, was very gratifying. The history, entitled "The First Half Century," which had been circulated throughout the industry, was fascinating to read.

It was a special honour, he thought, to be in the

* Shortly to be published in the JOURNAL.

† The picture was reproduced in the April 8 issue of the JOURNAL and the presentation is shown on page 462 of this issue.

Jubilee meeting and banquet groups (see facing page):—

(1) President's table at the banquet, with the president, Mr. E. Longden, on the right-hand side. On his right, in turn, are: Mr. A. R. W. Low, Parliamentary Secretary to the Minister of Supply; Mr. John Bell, the Institute's senior vice-president; Prof. F. C. Thompson, president of the Institute of Metals; and Mr. J. Shaw, member of the Iron & Steel Board (and chairman of Allied Ironfounders Limited). (2) Mr. M. M. Hallett (left) with Dr. A. B. Everest and Mr. R. B. Templeton at tea after the jubilee meeting. (3) Mr. S. H. Russell at the jubilee meeting presenting to the Institute a mounted photograph of the Middlesbrough (1906) convention assembly. On his right is Mr. V. C. Faulkner, joint author with Mr. Russell of the jubilee lecture, and on his left, respectively, the president, Mr. Longden, and Mr. T. Makemson, the secretary. (4) Group at a cocktail party preceding the banquet; included are (left) Mr. S. N. Clift, president, Manchester Association of Engineers; Mr. F. A. Wilson (foreground); and, on his left, four past-presidents of the Institute, Mr. P. H. Wilson; Mr. R. B. Templeton; Mr. J. J. Sheehan; and Major R. Miles. (5) Mr. N. P. Newman, past-president and honorary treasurer of the Institute, chatting with Mr. A. V. Sully (Mayor of Hendon), the Institute's auditor; in the centre background are Mr. W. G. Mochrie and Mr. G. L. Bailey, director, British Non-Ferrous Metals Research Association. (6) On the president's left at the banquet table were (left to right) Mr. A. Brizon, president, International Committee of Foundry Technical Associations (past-president *L'Association Technique de Fonderie*; Mr. V. Delport, representing the American Foundrymen's Society; Sir Archibald Forbes, chairman, Iron & Steel Board; Mr. F. W. E. Spies, president, Netherlands Foundry Technical Association; and Dr. H. S. Stannus, Master of the Worshipful Company of Founders.

chair during the Institute's jubilee year, and he thought it very fitting that Mr. Longden should occupy that position, for he had been a member during much of his lifetime and very active as a foundryman. In the "Foreword" of the history, the president in the last paragraph had written—"During the past fifty years many men have contributed to these results"—referring, of course, to the work of the Institute—"May their work be an inspiration and encouragement to those who follow." All would agree with these sentiments and it gave him great pleasure, on their behalf, to give the president a bound copy of the "First Half Century."

THE PRESIDENT, acknowledging the gift, said it would appear to be more by chance than design that he was president during that most eventful year. For many reasons it gave him special pleasure to be the recipient of such a valuable historical record by Mr. Makemson, first, because it was a work of a unique nature, especially in its implications, secondly it was a first-class literary effort, thirdly it was a valuable guide to the origin and development of the Institute and, fourthly, it helped one to renew old friendships through the written word and the illustrations.

Jubilee Lecture

Introducing the jubilee lecture to be presented that afternoon, THE PRESIDENT said the principal matter for which they had met was to hear the Paper "Development of the Foundry Industry during the Past Fifty Years," by Mr. V. C. Faulkner and Mr. S. H. Russell, past-presidents of the Institute. The Authors needed no introduction from him but he was pleased to say that he had known both Mr. Faulkner and Mr. Russell for many years. He called on Mr. Russell to present the Paper.

[The Paper was included in our April 8 issue.]

MR. V. C. FAULKNER, who followed Mr. Russell, said it was something like 37 years since he first met his co-Author. He had been sent to his works by the parent company of that which employed him to inspect a "not-too-pretty" casting. Mr. Russell looked as honest then as he did to-day and he convinced him that he could pass the casting—which he had done—with the result that the firm in question was still a regular customer. That early collaboration, which gave mutual satisfaction, continued, and when it was renewed in the collaboration on the Jubilee Paper, it was a very pleasurable interlude in his life.

Looking back over the past fifty years, one could see quite plainly that it divided itself into two periods. In the first, it was the metallurgist who made the major contribution to the foundry industry, but in the last 15 years or so it had been the engineer. For the future he thought it would be the scientist, who would play the important part.

Vote of Thanks

MR. J. W. GARDOM (past-president) proposing a vote of thanks to the Authors said members would, he thought, realize that both Mr. Faulkner and Mr. Russell had given of their best. They knew over a period of years what had happened and he hoped that some of the young men would really look through that Paper and be moved to say "Well, after all, our present-day ideas are something the older men thought of a very long time ago!"

MR. COLIN GRESTY (also a past-president) who seconded, said it gave him great pleasure indeed to support Mr. Gardom's proposal. Like Mr. Gardom, he considered it had been a most delightful *resumé* of what had been happening in the industry over the last fifty years.

[When put to the vote the resolution was carried with prolonged applause.]

MR. RUSSELL, acknowledging the vote of thanks, said when he had been asked to present the Paper he had felt it a great honour and took it quite seriously. He immediately started, last August, digging and delving in its preparation, but mainly he was indebted to many friends in the Institute for information of the existence of which he had previously not the slightest notion. To him it had been a very interesting period to cover; he thought, even, it might prove to be the most outstanding period in the history of iron casting.

MR. FAULKNER also briefly acknowledged the compliments they had been accorded.

[The meeting then adjourned for tea, preceding the jubilee banquet held later in the evening.]

JUBILEE BANQUET

The banquet held in the Café Royal, London, on Friday evening, April 9, to celebrate the Institute's jubilee, was an occasion which will remain in the memories of all who attended. There were present many distinguished guests, past-presidents, and other officers and friends of the Institute who have devoted a great deal of their time and effort to the advancement of its work. The president, Mr. E. Longden, M.I.MECH.E., received the company and presided at dinner.

The Toasts

The loyal toast having been honoured, MR. V. C. FAULKNER (past-president) presented formally to Mr. Longden an illuminated address of congratulations on behalf of the Norwegian Foundrymen's Association. The president received it with great pleasure, and on behalf of the Institute thanked the Norwegian Association for its good wishes.

MR. A. R. W. LOW, C.B.E., D.S.O., M.P. (Parliamentary Secretary to the Minister of Supply), proposed "The Institute of British Foundrymen." He began by confessing that on the last occasion—and there had been many—on which he had spoken to members of the British foundry industry he was in more fear than on the present occasion. His contact with founders dated from the time he began studying the Iron and Steel Bill; therefore, he had not always been very popular with foundrymen.

Emerson had said: "We do not count a man's years until he has nothing else to count," but it was different with associations and institutes, and it was more than salutary in these days—when men were apt to forget the deeds of their ancestors and to denigrate the 30's and the 20's and the early 1900's—to remember that leaders of the founders had for 50 years put into practice in their scientific and educational Institute some of the fundamental principles which all knew were vital to productivity. They had built up a fine organization for the investigation of scientific problems of interest to the foundry industry.

Throughout the 50 years of the Institute's life, the foundry industry had always been refreshingly and vigorously competitive. To-day world competition was a fierce as it had ever been, and the standards demanded and expected of Britain were higher than ever. He knew and welcomed the fact that the Institute had branches in the British Commonwealth—in Australia and South Africa, represented at the banquet. He knew, too, that there were present at the banquet prominent representatives of founders in the U.S.A., in France, Holland and Belgium. Nevertheless, members would not be surprised to hear him remind the Institute that it served a competitive industry—none the less competitive, and much more-successfully competitive, because of the measures of co-operation that the Institute effected.

Pooling of Knowledge

More and more people, as each year went by, accepted the fact that the pooling of knowledge which led to technical progress was not a loss to the individual who did it, but a gain to the industry as a whole, and that a gain to the industry as a whole was a gain to the individuals composing it. The Institute had taught that lesson.

After relating a story which, he said, reflected great credit on the solidarity of the foundry industry and emphasized the hardships of the unhappy member of parliament, Mr. Low spoke of the men who formed and led the Institute. First he mentioned its secretary, Mr. Makemson, who during 28 years in office had watched the membership grow from 1,300 to over 5,300. That proved the value of the Institute's work as well as the value of the secretary, who also had had the time and energy during the war to join the Ministry of Supply as Director of Iron Castings. One did not know which job he had found to be the more peaceful!

In a final tribute to the president, whose name he coupled with the toast, he said Mr. Longden had been in the foundry industry since he had started at the "advanced" age of 14 and had worked his way to the top, being now a foundry consulting engineer. He had advised the Yugoslav Government on the foundry industry and had acquired a world-wide reputation on the technology of shrinkage and contraction of castings.

President's Reply

THE PRESIDENT, on rising to respond, first read a telegram from Mrs. F. J. Cook, the wife of a foundry technician well known to all in the Institute and who was one of the Institute's pioneers. It conveyed congratulations and best wishes for the Institute's future.

It was with considerable humility, he continued, that he responded to the toast, so ably proposed by Mr. Low, who had an amazing knowledge of the ramifications of the Institute. He was also very proud to reply on behalf of the Institute on that very historic occasion, when the cream of the technical foundrymen of this country, and many from abroad, were gathered together. The words of Mr. Low led one to feel that, though there was lack of unity in the world to-day, the Institute and its foreign friends managed to get along exceedingly well together; and the president felt that they, perhaps, did more for international unity than did all the politicians in the world.

In thanking Mr. Low on behalf of the Institute and himself for his very kind and able proposal of the toast, the president said that he personally had been very fortunate indeed to be associated with the men who were around him on that occasion.

Kindred Associations

MR. JOHN BELL (senior vice-president of the Institute) proposed "Kindred Associations at Home and Abroad." We were told, he said, that if a man would have friends he must first show himself to be friendly. That applied to us all, individually and collectively, and that gathering of friends at the banquet was a tribute not only to those few men, who, 50 years ago, with great courage and daring had formed the Institute, but also those who had worked for it and had steered it through the years and had brought the members and their friends rejoicing to their particular haven that evening. Most of the associations represented at the banquet, he continued, were of British origin, and the Institute also welcomed most gladly those gentlemen who represented kindred associations in countries across the seas.

Speaking of the kindred associations individually, he said the American Foundrymen's Society was represented by Mr. V. Delport, whom most of the members of the Institute had known for many years. Mr. J. Goffart, the president of the *Association Technique de Fonderie de Belgique*, was another welcome guest; many of the members of the Institute retained happy recollections of visits to his country. Mr. A. Brizon, from France, president of the International Committee of Foundry Technical Associations, and a past-president of the *Association Technique de Fonderie*, and Mr. F. W. E. Spies, the president of the Netherlands Foundry Technical Association, also honoured the occasion by their presence. Those gentlemen from overseas had, like members, devoted much time and energy to finding new metals, new materials, new methods of manufacture, in order to improve still further both the quantity and the quality of their castings.

The Institute had been helped very much by the research associations. The British Cast Iron Research Association was represented by Dr. J. G. Pearce, its director, and by that lovable personality Mr. J. J. Sheeehan, its chairman of Council; the

British Steel Castings Research Association by Mr. C. H. Kain, its chairman; and the British Non-ferrous Metals Research Association by Mr. G. L. Bailey, its director. The Institute of Metals was represented by its president, Professor F. C. Thompson; the Manchester Association of Engineers by the president, Mr. S. N. Clift; and the Institute of Vitreous Enamellers by its vice-president, Sir George Briggs. To those gentlemen and to the many other guests who were present Mr. Bell offered a very warm welcome.

European Collaboration

MR. ACHILLE BRIZON, responding to the toast, addressed the gathering in French, and his remarks were interpreted by Mr. Delport. He said he had much cause to be happy in being present on that occasion. He had been delegated by the *Association Technique de Fonderie* (of Paris) to convey the greetings of French foundrymen, and to extend best wishes for the success of the Jubilee celebrations and the continued prominence of the Institute.

Again, as president of the International Committee of Foundry Technical Associations, he had the honour to represent some thirteen associations which made up its membership, and he rejoiced in the presence of his friend, Mr. Spies, president of the Dutch Association, and Mr. Goffart, president of the Belgian *Association*. He was convinced that the thoughts of the presidents of the member associations of the International Committee converged towards the Institute's assembly, and he was their representative in conveying, on the occasion of the Jubilee, the expression of their regard and high esteem.

Apart from the tremendous work done by the Council and Technical Committee, which had raised the membership to some 5,300, a very important aspect of the Institute's activities, which deserved special mention, was the development of international relations, started in 1918 and which, in collaborations with other associations, the Institute had helped to extend. That progression had culminated in 1926 in the foundation of the International Committee at a meeting held in Brussels on the initiative of Mr. Paul Ropsy, then president of the Belgian foundry *Association*. At that meeting were present Mr. Faulkner, Mr. Makemson, Mr. Emile Ramas, of Paris, and Dr. Geilenkirchen, representing Dr. Werner. On the occasion of the Institute's jubilee, said Mr. Brizon, homage should be rendered to those pioneers.

Finally, as a Frenchman, he referred to another jubilee which should unite the thoughts of those present—that of the *Entente Cordiale*, the instrument of which was signed on April 8, 1904. He concluded: "May this *Entente* become ever closer for the good of our two nations and the maintenance of peace."

Mr. V. Delport added that, since the president and Council had done him the honour of inviting him to attend the banquet in his capacity of European representative of the American Foundrymen's Society, he could not let the occasion pass without conveying the greetings of that Society.

Among Friends

MR. F. W. E. SPIES, who also responded, said he believed he was the "youngest" member of the Institute, and was proud of it. He had the honour to speak on behalf of the kindred associations in Great Britain and the other countries represented at the banquet and to tender to the Institute of British Foundrymen most hearty congratulations on its 50th birthday. They were all very grateful indeed to have the opportunity to take part in the Institute's jubilee, and he thanked Mr. Bell for the extremely friendly and encouraging words he had addressed to them.

If he were asked what to say about the value of technical associations generally and foundry technical associations in particular, then he would say that what they had seen and heard during the international congresses and the numerous visits they were allowed to pay to their old and new friends in the different countries had encouraged the Dutch foundry industry to establish a foundry research Institute, which had never existed before in their small country. The example of the British Cast Iron Research Association, the British Non-Ferrous Metals Research Association and the *Centre Technique de Fonderie* in France had been used as a convincing argument to take that final step.

The Guests

MR. M. M. HALLETT, M.SC., F.I.M., M.I.MAR.E. (president of the Sheffield branch of the Institute), proposed "The Guests." It was a privilege which was appreciated very much by the Sheffield branch and by himself, he said, that he should be asked to speak for the ordinary members of the Institute and to propose the health of such a distinguished body of guests. It was certainly a pleasure to welcome as friends and relations to the family party so many who had accepted the invitation to be present.

The principal guest was Mr. Low, whose admirable speech had been received with the greatest appreciation. He was one of those barristers who had turned to an honourable profession and had become a politician. He had also a very distinguished war record, in which he had attained the rank of Brigadier, and, in addition had been awarded the Distinguished Service Order, the *Croix de Guerre*, and the U.S. Legion of Merit.

Mr. Hallett then proceeded to enumerate the qualities of a number of prominent guests and representatives of learned bodies who were present. He concluded by expressing the corporate thanks of the Institute to all its numerous guests, coupling with the toast the name of Sir Archibald Forbes, chairman of the Iron and Steel Board and past-president of the Federation of British Industries.

Satisfied Co-operators

SIR ARCHIBALD FORBES, responding, said it was for once his pleasant duty to speak on behalf of a number of satisfied persons.

Sir Archibald's speech was entertaining, with asides here and there, a quotation and even rhyme. Not all the guests, he continued, came from organizations which were in sight of a jubilee marked by even baser metals than gold; and his own organization had not yet attained its first birthday. The first Iron and Steel Board never knew how popular it was until after its demise; and in view of the extreme youth of the present organization he was certain Mr. Shaw would be with him in saying that they were prepared to forego for a time the pleasure which their executors might derive from the obituary notices! As Mr. Hallett and Mr. Low had indicated, happily the shadow of the Board fell lightly on the sunny serenity of the foundry industry. Only in extreme circumstances would the Board have to deal with such sombre questions as those affecting prices and development. It seemed to him, therefore, that the foundry industry had steered a skilful course between the Scylla of supervision and the Charybdis of the Commission on Monopolies. Long may it sail in those untroubled waters!

Becoming serious for a moment, Sir Archibald said the Board had certain responsibilities towards the industry, and not least in the furtherance of some of the primary objectives of the Institute. In those, as in other matters, the Board would have no success if it could not gain the confidence of the industry, of the consumers of its products and of the public generally; that was indeed the aim of the Board, and it would welcome help, advice and even criticism the industry could give at any time.

The Secretary

MR. N. P. NEWMAN, J.P. (past-president and hon. treasurer of the Institute, and chairman of the Council of Ironfoundry Associations) proposed the toast of "The Secretary," Mr. Makemson. Referring to him affectionately as "Tom," Mr. Newman said that most of the members present already knew so much about him that one need extol his virtues for only a comparatively short period, but for the benefit of the younger members it would be appropriate to mention a little of his background, and this he proceeded briefly to do, mentioning that the Institute had been the one real interest in Mr. Makemson's life, and he had devoted himself wholeheartedly to its affairs and to its members.

[The toast was given with enthusiasm, and with musical honours.]

MR. T. MAKEMSON, M.B.E., confessed that he found it difficult to respond adequately; he just did not recognize himself. He thanked Mr. Newman for his most generous tribute to his work, and the gathering for the handsome way in which they had received it. The work of the Institute was carried out by a very, very high proportion of its members, some had risen to the top and had become presidents, some had remained in obscurity, but nevertheless contributed their effort, sometimes in the way of helping a fellow member over an occasional difficulty. His job had been to carry out the administrative tasks and to co-ordinate the work of all those people.

FIG. 2.—*Some of the members and guests assembled at the banquet held to celebrate the golden jubilee of the Institute of British Foundrymen, in London on April 9.*

Shell-Moulding Association

A very well-attended meeting of firms interested in the formation of a shell-moulding association was held at the Queens Hotel, Birmingham, on April 14. Those attending the meeting included firms engaged in the iron, light-metal, bronze and brass and steel founding industries, together with manufacturers of shell-moulding machines and equipment, in addition to resin manufacturers. The object of the meeting was to consider what steps should be taken to form an association of firms interested in the shell-moulding industry and, for this purpose, the following committee was appointed:—Mr. G. Skript, Langley Alloys, Limited (chairman); Mr. W. A. Bannister, C. & L. Hill, Limited; Mr. A. S. Beech, Foundry Equipment, Limited; Mr. R. S. Bushnall, British Industrial Plastics, Limited; Mr. A. C. Cable, British Resin Products, Limited; Mr. R. D. Cheyne, Coleman-Wallwork Company, Limited, and Stone-Wallwork, Limited; Mr. A. A. Chubb, Fairbairn Lawson Combe Barbour, Limited; Mr. G. G. Harrington, Qualcast, Limited; Mr. W. T. Hill, Samuel Osborn & Company, Limited; Mr. W. T. Hobkirk, J. Hobkirk, Sons & Company, Limited; Mr. A. P. Lovat, British Industrial Sand, Limited; Mr. K. Meyer, Mellor Mineral Mills, Limited; and Mr. A. Short, Rolls-Royce, Limited. A representative from the Aluminium Development Association has also been invited to join the committee.

The objects of the association will include:—

1. To take such collective action as may be necessary to safeguard the interests of members and to ensure that the basic use of the process is available to all.

2. To provide machinery for the exchange of information individually and collectively on all aspects of shell moulding and to encourage collaboration between founders, machine makers, and suppliers of material.

3. To safeguard the industry so far as commercial matters are concerned. A meeting open to all firms interested will be held in Birmingham towards the end of June, of which notice will be circulated by the secretaries, Heathcote & Coleman, 69, Harborne Road, Edgbaston, Birmingham, telephone EDGbaston 4141.

CORRESPONDENCE

FOUNDRY INDUSTRY IN 1953

To the Editor of the FOUNDRY TRADE JOURNAL

May I refer to the figures given in your leading article, "The Foundry Industry in 1953," in your issue of April 1?

Your calculation of the increase in productivity appears to be based upon a figure for labour employed that is not strictly accurate by your definition; 9,105 of those whom you classify as process workers in 1953 are, in fact, not so, and the resultant calculation of the increase in tonnage output per man-year should therefore be 12.3 per cent. This is the true calculation based on process work only.

Strictly speaking, the figure at the end of 1950 comparable to that for 1953, quoted in the statement of output you published on page 322 of your issue of March 25, is 150,329 persons.

Yours etc.,

BASIL H. TRIPP.

Information and Press Officer,

The Council of Ironfoundry Associations.

Crusader House,

14, Pall Mall,

London, S.W.1.

April 12, 1954.

National Society of Master Patternmakers

The National Society of Master Patternmakers held their inaugural general meeting on April 8 at the Queens Hotel, Birmingham, when 33 firms from various parts of the United Kingdom were enrolled as the first contingent of founder members. This list of founder members will remain open for one month, after which firms or individuals will join as ordinary members.

The objects and rules of the Society as circulated on March 19 were approved and adopted unanimously, with the addition of a clause providing for the admission of small firms employing not more than five workers, such firms being admissible on a reduced subscription of two guineas, the entrance fee remaining the same. For other firms the terms are: Entrance fee for founder members, three guineas (afterwards four guineas); annual subscription (not more than 10 workers), five guineas, or over 10 workers, ten guineas.

The Society by unanimous vote elected Mr. B. Levy, of B. Levy & Company (Patterns), Limited, London, to be their first chairman and president, with the following as members of the executive council:—

> Mr. L. Brown, Premo Pattern Company, Limited, Birmingham; Mr. N. Fisher, Universal Pattern Company (London), Limited, London; Mr. N. Gott, Hargreaves & Gott, Limited, Rochdale; Mr. W. D. Hartley, Fellows & Darby, Limited, Birmingham; Mr. E. C. Rowen, Pattern Equipment Company (Leicester), Limited, Leicester; Mr. R. Sarginson, Sarginson Bros., Limited, Coventry; Mr. R. Scott, H. C. Hopper (Kingston), Limited, London; Mr. R. J. Seymour, Seymour's Castwell Foundry, Limited, Derby; Mr. J. Vickers, John Vickers & Sons, Darlington; Mr. A. Whitehouse, Pattern & Model Manufacturing Company, Limited, Coventry.

After enrolment of members it was proposed and carried unanimously that Mr. V. C. Faulkner, the Editor of the FOUNDRY TRADE JOURNAL, be elected an honorary member of the Society in recognition of the support and work he has given to the commencement of this new co-operative group.

Proposed Activities

Members' suggestions for action by the Society included the following proposals:—The initiation of a "code of good practice" for patternmaking; investigation into the setting of British standards for manufacture of pattern equipment; standard conditions of sale; representation to national negotiating bodies on all matters affecting patternmakers; and, of course, increase of membership. The cordial atmosphere and enthusiasm of the founder members at this inaugural meeting of the new Society was a most noteworthy feature, pointing the way ahead for a progressive movement towards the wellbeing of the patternmaking industry. The National Society of Master Patternmakers, being a representative body from all parts of the United Kingdom, will now be in a position to improve and extend the status, popularity and employment of master patternshops, which laudable aim must in its outcome be of great benefit to the engineering and foundry industry as a whole.

Mann, Judd & Company, 8, Fredericks Place, London, E.C.2, the appointed secretaries, will be pleased to send forms and particulars upon receiving communications from those interested.

Shell-moulding Developments in America

By B. Walters, Ph.D.

This article records impressions and data relating to shell moulding gathered during visits to many American foundries. These foundries were of various types both ferrous and non-ferrous. The aim is to attempt an evaluation of the process as at present operated in the U.S.A., with particular attention to assessing the important details of the technology of shell-mould production.

Introduction

To recapitulate briefly what is already known to most founders, in shell moulding a resin/sand mixture is dumped on to a heated patternplate so that a thin skin, some ¼-in. thick, is formed. Subsequently excess of the mixture is removed, and the patternplate and shell are further heated so that the resin is caused to cure or set into a biscuit-like contoured shell. After this, the shell is removed from the patternplate and used to form one half of a mould for metal casting. A typical shell-moulding process employs a pattern temperature of about 200 deg. C., uses 100-grade A.F.S. washed silica sand (any clay present requires more resin), a 6½ per cent. resin content and the resin/sand is mixed for about 15 min. A "dwell" time of 10 sec. for the sand/resin mixture in contact with the pattern and a curing time of 15 to 30 sec. at 350 deg. C., with 1 min. total cycle time, are common.

At present the main limitations of this technique still arise from high cost of resin, the need for quite expensive metal patterns, and from complications attendant on controlling the dimensions of the castings with the accuracy of 0.003 in. per in. of which the process is, in the utmost, capable. Almost all common ferrous and non-ferrous casting alloys are currently poured by this method, with the exception of mild steel, where difficulties due to casting porosity and carbon pickup are reported.

Installation of Shell Moulding

Many American foundries show similar development processes in their installation of shell moulding. These usually embody the following stages: First, shell moulds are bought and a few test castings are made. After this a small cheap machine is installed and with this experimental shell moulds are made, variables such as pouring temperature, shell forming and curing temperatures, and gating systems are investigated. At this stage of the work, production matchplate patterns of aluminium are often used. These do not possess sufficient accuracy to permit the attainment of the closest dimensional tolerances that shell moulding can yield, but they are readily available in almost any American foundry. The final stage in the process development is the installation of a machine, whereby shell moulding can be mechanized.

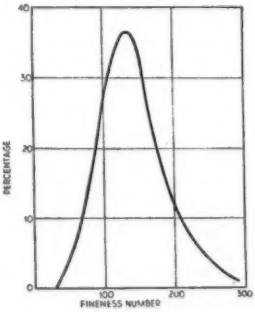
Cores may also be made using the same shell technique, with the use of only very simple equipment. The general procedure here involves heating a metal corebox to about 250 deg. C. The resin/sand mixture is then dumped into the box, a measured quantity being employed. Excess sand is then rapidly poured out and the box is subsequently again filled, given a dwell time of about 15 sec., and again dumped out. The coating formed during the first operation is slightly thicker at hot spots. This insulates these spots during the second sand addition, and in this way a greater uniformity is obtained in the final shell. Cores may also be blown, great attention being paid to the pressures employed, as described later. With most core-blowing methods, means must be provided for removing the excess sand mixture. Thus, the capital expenditure required to investigate the possible application of shell moulding is not large, and the process may be tried experimentally with simple equipment and fairly rudimentary technical knowledge.

It is in the broader aspects of shell-moulding production that American practice is most highly developed. In many instances there, shell-moulding machines may be regarded as standard production equipment, and many production problems, as contrasted with experimental problems, have been encountered and at least partly solved in the U.S.A.

Investment Operation

A thermosetting resin is used in shell moulding. This softens and fuses at a slightly elevated

FIG. 1.—*Fineness distribution of a sand suitable for shell moulding.*



* The Author is now associated with William Jessop & Sons, Limited, Sheffield.

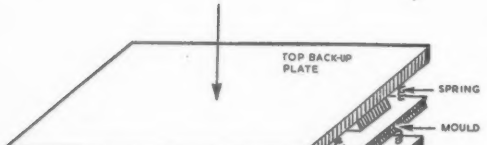


FIG. 2.—*Diagrammatic representation of a clamping device for use in the sticking of shell moulds with adhesives.*

temperature, as used in the investment operation, but on heating to a higher temperature it hardens and does not re-soften on cooling. This higher temperature is used in curing. If heated too much, the resin decomposes.

Resins generally employed in the U.S.A. are of the urea- and phenol-formaldehyde types, as in England. Again, as here, "hexa" (hexamethylene tetramine) is sometimes added as an accelerator. Amounts of resin used in the sand mixture vary in practice from 5 to 10 per cent, being lower for low-melting-point metals. Generally, however, between 6 and 8 per cent is employed. This is normally mixed with the sand after the addition of a wetting agent, but "pre-coated sands" are now available.

A defect to which shells are prone is known as resin segregation. This results from the separation of resin and sand so that a shell is in local areas of too high a resin content. This is often worse in shell cores than in shell moulds. To minimize this segregation, the mixing operation and the action of any wetting agent added must be efficient. In this respect, a pre-coated sand has an advantage, since efficient mixing is ensured, though since there is now much interest in sand reclamation (by burning out the resin at some 750 deg. C.) the use of pre-coated sand may present difficulties.

The production of turbulence of the sand/resin mixture adjacent to the heated pattern during investment also promotes resin segregation, since this provides maximum opportunity for constituents to separate. Thus the use of a positive-pressure type of dump box would appear to be advantageous, though the Author has no personal experience of its operation. Another device that assists in uniformly covering the hot pattern with sand/resin mix during investment period is a series of shutters incorporated in the dump box and acting like Venetian blinds. These, however, should not act in such a manner as to diminish the tightness of the sand packing. To cut down turbulence in core-blowing of shells, the mixture should be measured so that only just the right quantity is introduced with each blow, and any excess introduced should not be re-used before remixing. Also, the first sand should be introduced to the corebox under only a very small pressure so that the shell formed immediately at the corebox face, where segregation would be most troublesome, is produced under the most favourable conditions. With the rest of the sand, pressures employed in the core-blowing operation should not exceed 40 lb. per sq. in.

Surface Finish

The high surface finish attainable with a shell-moulded casting is one of the main advantages of the process. To obtain the optimum finish, a semi-angular sand is used, a typical grain distribution being shown in Fig. 1. For larger castings, where more surface roughness is permissible, a somewhat coarser sand is used.

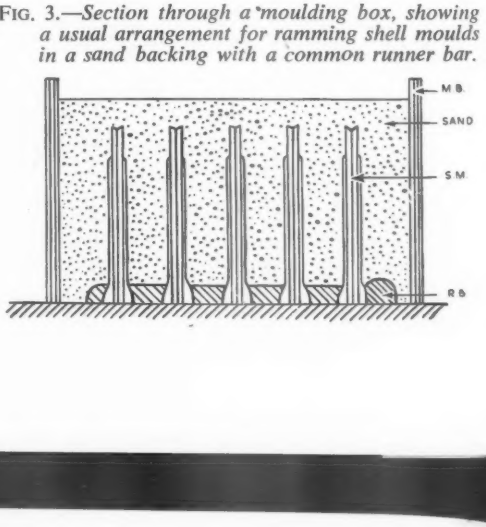
A highly-glazed surface on the shell is undesirable, since it indicates either too high a resin concentration in the sand, or resin segregation at the mould face. Such a condition produces a rough surface on the casting and gives rise to excessive gas, due to the effect of the hot metal on the resin which may result in casting porosity.

Mould Warpage

When a mould is stripped from the patternplate it is almost invariably slightly warped. This may arise from one of two causes. The first is found with large patternplates where there may be pulling away of the shell from the plate due to lateral temperature gradients established in the shell, which will then be both warped and non uniform. The second cause of warpage is the handling of the shell after it is made. The remedy for the first defect is the careful positioning of the electric strip heaters that are built into the production patterns. With multiple patternplates the plate size need not be reduced and this type of warping can be overcome without recourse to smaller plates which would usually result in a sacrifice of production.

Warpage arising from the handling of the shell during stripping and mould closing is, however, probably more common. To overcome this, the shell, after stripping, is "set" over a cold metal pattern to cool, and is spring loaded at the back.

FIG. 3.—*Section through a moulding box, showing a usual arrangement for ramming shell moulds in a sand backing with a common runner bar.*



Modifications of this method that may be introduced involve water-cooling of such a pattern, or the shell, or both. The process in which the shell is directly cooled with water is interesting, in that water is prevented from entering the shell because of its resinous nature. Also, should any moisture enter the hot shell it is rejected as steam which can readily escape from the highly-permeable material. Water should not, however, be used on a shell which is below 100 deg. C.

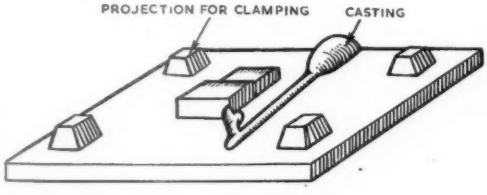
Warping may also be minimized by effective clamping of the shells. This is considered in more detail later. Distortion during casting is, however, sometimes encountered even when the shells are properly straightened and clamped. This may sometimes be avoided by the more liberal use of clamps, by supporting the mould internally, employing a two-dump shell-production cycle, or by adjustment of the sand/resin mixture. Such distortion may, however, arise from improper shell curing. Under-curing causes the mould to bend under the action of heat and metallostatic pressure. Over-curing gives distortion as a result of a series of cracks being formed at the mould surface. Incorrectly cured moulds may usually be detected by their colour—a properly-cured shell being of a medium brown colouration but depending somewhat on the resin employed. A similar condition to that of an over-cured mould also arises when an attempt is made to make heavy castings by an inappropriate technique, with insufficient mould support.

Closing a Shell Mould

Methods used in closing shell moulds are very important, and are particularly so if the casting is to be made without backing material. This is because any fin which may be formed opens the two halves of the mould causing incorrect dimensions to be produced. It may even, in severe cases, lead to run-outs.

In America, shell moulds are usually closed with adhesives, sometimes in conjunction with an auxiliary support. Methods of closing such as by the use of bent nails are obsolete. An adhesive which is often employed is the same resin as used for making the shell. In applying this, one half of the mould is set down with the surface to be struck facing upwards. Cores are then set, and the mould cavity is covered with a template to prevent resin falling into the cavity during the next operation. Then, while the half shell is still warm, dabs of resin are put on the flat faces to be in contact with

FIG. 4.—*Shell pattern showing the projections sometimes incorporated for location when clamping so as to cast vertically.*



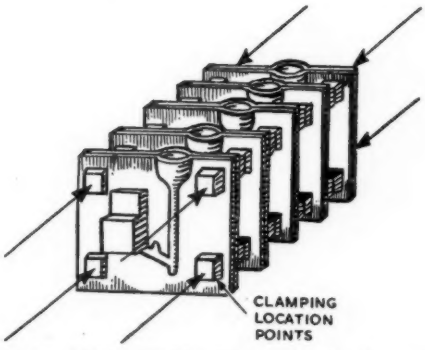


FIG. 5.—*Shell moulds as produced from the pattern shown in Fig.* 4 *set up for clamping.*

the other half at frequent intervals. This resin flows slightly so that it sticks to the mould. The quantities used must be adjusted so that all the resin applied does not flow too soon and become absorbed into the mould. Next the second half shell is placed on, immediately it is stripped from the patternplate. After this, the two halves are compressed together so that they stick firmly. The most critical part of this operation is the adjustment of the amount of resin so that, on the one hand, it does not flow into the mould and become absorbed or, on the other, forms small resin lumps which keep the two mould halves apart.

As an alternative to resin, a core-paste or proprietary plastic glue may be employed. This is applied either using a template as for the resin adhesive, or, with the mould face downwards, applying the adhesive to a predetermined pattern with a standard core-pasting fixture. If a paste is used, the second mould half should not be as hot. A delay of about 2 min. between stripping the shell from the pattern and pasting the two shells is suitable.

To clamp the halves together for sticking, some form of compression device is used.

In America, a popular one consists of a series of weak springs (about 7 lb.) mounted on a plate which is clamped against a series of similarly-mounted springs set opposite, with the mould in between, as shown in Fig. 2. Since these springs must act directly across the mould and not bear on a mould cavity (if they did so the cavity would be distorted and might break) provision must be made for moving the springs around on their back-up plate. This can be done if the back-up plates are drilled all over with holes spaced about $\frac{1}{2}$ -in. apart so that the springs can be moved around and set in the positions necessary for different types of shell moulds. An ingenious idea that has been investigated involves the use of a magnetic plate on which the springs can be moved to any position at will. The two spring-bearing plates may be compressed together hydraulically, or they may simply be hinged together appropriately and locked in place by a suitable clamp, as shown in Fig. 2.

The spring method of compression suffers from

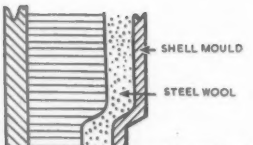


FIG. 6.—*Section showing the arrangement of a half shell for clamping with the aid of a plaster cast.*

disadvantages in that the springs have all to be moved whenever a pattern change is made. To overcome this, research work is now being carried on to investigate the possibilities of direct pressure application to the mould halves, by such means as balloon-type structures. With this method there are difficulties in finding a suitable material of which to make the balloon though the interposition of an insulating layer such as glass wool or asbestos between the balloon and the shell at least seems possible.

Backing a Shell Mould

Present trends in shell moulding in America as well as this country are towards the elimination of back-up material when casting. This is in many ways a very attractive proposition, since the backing involves the expense of both back-up material, usually steel shot, and also capital equipment (costing perhaps, $100,000) to cool this material and separate out any sand that may be picked up.

If back-up material is used, shot is not the only possible material. Certainly it can be used, as in the original "C" process, and such a material as size-16 blast-cleaning abrasive shot is suitable. Its density must be maintained above 2.2 oz. per cub. in. otherwise excessive sand contamination with consequent permeability loss, is indicated. Alternatively, gravel or sand may be employed. Gravel has the advantage of not reducing the effective permeability of the shell mould so much as sand, while the main advantage of sand is its convenience and availability in the foundry. If sand be used, the casting can be rammed on a standard jolt machine, the moulds being inverted on a standard runner bar as shown in Fig. 3. Alternatively, the moulds may be rammed right way up, the shells initially being placed on a grid. Castings can then be shaken out on an ordinary vibrating screen with only the minimum of sand contamination by the shell material.

If castings are not too big, however, they can be poured without back-up material. Normally the moulds are stood vertically for this operation. Often shells can be designed so that parts of them stand proud of the rest of the shell, as shown in Fig. 4. The moulds can then be set up to touch across these points and in this way a number can be clamped together (Fig. 5). Experiments have also been carried out in which a plaster cast has been made of the back of the shell and this has been clamped against the shell using steel wool between the shell and the plaster (Fig. 6). As an alternative to vertical pouring, for larger castings the metallostatic pressure head which the mould is called on to resist can be reduced by pouring the moulds on their side.

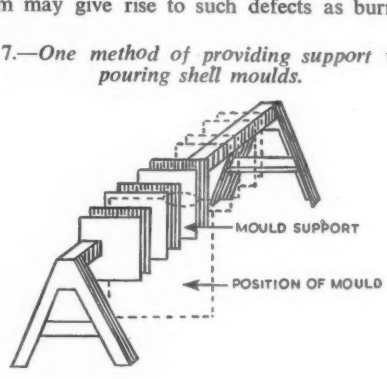
In some circumstances, stack-pouring may be employed for shell moulds. For this, the moulds are placed one on top of the other, the pressure of one mould on the next helping to keep them closed. For casting like this, clamping projections are necessary, and the outer top and bottom faces of each shell must be rubbed flat on an abrasive wheel before stacking. The ingate is usually opened up during this grinding process. In this case, initially, the gate takes the form of an elevated portion on the pattern, and is at first covered by the shell material. Also, if this method of casting be used it is important that the moulds should be flat, and to ensure this stiffeners are sometimes incorporated in the shells.

Fixtures used to support shell moulds when poured vertically should not involve supports near the floor where they will be fouled with spilled metal. On the other hand, such structures must be strong enough to withstand foundry service. A design found very useful in practice is shown in Fig. 7.

Gating a Shell-moulded Casting

In gating a shell-moulded casting the aim is to obtain a steady rather than an extremely rapid filling of the mould. For this reason, and because of the high porosity of shell moulds, downgates have but 70 per cent. of the cross-sectional area of those used in comparable sand moulding. This, in general, gives up to 10 per cent. increase in yields of casting to metal poured. Among other things, steady mould filling gives better slag metal separation during the filling of the mould. If faulty gating is employed, the shell surface may be "washed" by the inflow of metal and the gating system may give rise to such defects as burn on,

FIG. 7.—*One method of providing support when pouring shell moulds.*



rat-tailing, or what is apparently occluded slag. In severe cases, there may be runouts.

The metal may be made to enter the mould steadily by bottom gating through narrow runners. Slag traps are usually employed, while gating into small blind risers which communicate with the casting through small openings is also a useful device. Such risers should be placed less than $\frac{1}{4}$ in. from the part of the casting which they feed. Gates should not enter mould cavities so as to lead the metal to impinge directly on to cores, since in these conditions the metal is prone to "wash" the core. Similar principles apply in the positioning of risers and feeders as for sand castings, though the application of accepted principles usually gives rise to feeding and gating systems different in shell moulds from sand moulds. For instance, smaller risers may often be used in shell moulds.

Pattern Materials

The two materials most commonly used for making shell-moulding patterns are aluminium and cast iron. The main advantage of aluminium is its easy machinability and the convenience with which it may be precision cast, *e.g.*, by a plaster pressure-casting process. Thus for an experimental set-up, aluminium is probably the most suitable material. It has disadvantages, however, in that its specific heat is rather low, about 60 per cent. of that of cast iron, and its conductivity is some 250 per cent. higher. Thus patterns made from aluminium cool more quickly on being transferred to a dump box for investment. Also the coefficient of expansion of aluminium is about double that of cast iron, resulting in slightly increased difficulty in maintaining accurate casting dimensions. The major disadvantage of aluminium, however, especially in production operations, is stated to be a tendency to pitting after prolonged use, although aluminium patterns have been in use for over 10,000 cycles without showing appreciable wear.

Cast iron is much better adapted to production operations in shell moulding since it is stable at all temperatures used in the process. Its major disadvantages are its greater density, making a pattern heavy to transfer from furnace to dump box, and the fact that cast-iron patterns are about three times as expensive as aluminium ones. But cast iron retains heat well, and its disadvantages are such that they would be felt most severely only in small-scale operations.

Copper-base materials have also been used for shell patterns. These are most useful in conjunction with electrical pattern heaters, where their good thermal conductivity permits rapid equalizing of temperatures over the whole pattern face. A disadvantage might be the possible softening of these alloys on raising the temperature; but their hardness at room temperatures is satisfactory, being 135-180 Brinell.

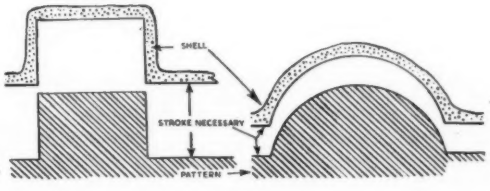
Pattern Design

In shell moulding, satisfactory shell stripping involves suitable pattern design and surface preparation. A pattern must be really smooth—about 40 R.M.S. minimum is quoted in America for all pattern surfaces. Pattern pretreatment is also important. This aims at providing an initial coating to fill in any crevices due to machining. Such a coating usually takes the form of a silicone oil which hardens on heating. It is renewed periodically, after the production of between 1 and 8 shells, by spraying on to the hot pattern a suspension of the silicone oil in water or an organic solvent, care being taken to avoid localized build-up of the deposit on the pattern. This spraying process is at present naturally a limitation on the rate of mass production of shells.

Ejector pins are usually used to remove the shell from the pattern. Though recent English reports suggest that a frame may be used instead, this frame type of mould removal has been observed only in very simple shell-moulding operations in America. A distance between the ejector pins of about 1 inch on the patternplate has been suggested as necessary. Many satisfactory layouts, however, employ a much smaller concentration of ejector pins, though where shell stripping is difficult, as, for example, at a small area of a pattern surrounded by nearly vertical faces, a higher pin concentration should be used. Appropriate draft, of at least half a degree, should also be provided on the near-vertical faces.

Ejector pins may be flat or round-headed. Pins with flat heads do not alter the pattern shape, but they must be machined flush with the pattern surface and be a good fit with the patternplate hole in which they work. Pins with rounded heads have the advantage of permitting a looser fit in patternplate holes, because they have flanges which prevent sand getting down between the pin and the plate. Also, the upward stripping thrust on the shell is obtained without any severe lateral thrust, even though the pin may not move upwards in an exactly vertical direction. With the round-headed pin, care must be taken to ensure that no sand gets under the head of the pin to interfere with its seating on the patternplate, though the danger is not great. A suitable diameter for ejector pins is $\frac{1}{4}$ in.; with round heads, the head should be about $\frac{1}{2}$ in. diameter and $\frac{1}{4}$ in. high With an "average" shell pattern, a suitable length for the ejector stroke is $1\frac{1}{2}$ inches. The aim should be to have the stroke sufficiently long to lift the shell quite clear of the patternface. Thus a large, nearly-vertical patternface area, as in Fig. 8 (*a*), necessitates a longer stroke than can be used in the absence of such an area (Fig. 8 (*b*)). The ejector pins are provided

FIG. 8 (*a*) AND 8 (*b*).—*Sections showing the stripping movement requirements for differing designs of casting.*



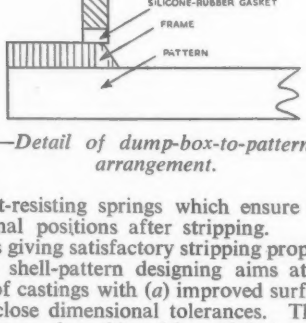


FIG. 9.—*Detail of dump-box-to-pattern sealing arrangement.*

with heat-resisting springs which ensure return to the original positions after stripping.

Besides giving satisfactory stripping properties, enlightened shell-pattern designing aims at the production of castings with (*a*) improved surface finish, and (*b*) close dimensional tolerances. The first of these aims can be achieved by satisfactory attention to pattern finish, resin/sand mixture, and investing and curing techniques, as described previously.

Tolerances

Before considering tolerances attainable from shell-moulding operations, it is appropriate to note that the surface of a casting produced by this method is not like a finely machined surface. But by putting a measuring instrument such as a micrometer across two surfaces of a shell-moulded casting a measurement may be obtained of the distance between those surfaces. Strictly the surface thus defined will correspond to the asperities formed as the metal of the casting flows into the mould and between its small sand grains. This definition completely parallels the conventional engineering method of defining a surface the only difference being that the asperities used to represent the surface in the latter method are those between cutting-tool grooves. In a shell-moulded casting also, surfaces thus defined may be said to be placed within certain engineering tolerances. Tolerances ordinarily quoted for a shell-moulded casting at present, are of the order of 0.003 in. per inch, except across the parting line, where they are 0.015 in. plus 0.003 in. per inch of casting section. These tolerances are attained in America with controlled practice, though an associated problem of the production of large casting areas free from even the slightest defect is still not completely solved.

The pattern for a shell-moulding process is usually developed in America by several stages. First a pattern is made with about 0.015 in. extra machining allowance on all faces. This allowance may sometimes be reduced even initially, but only on the basis of prior experience. From this pattern experimental shell moulds are made, curing times are established, electric heaters are located, and a standard production cycle and technique is set. From these experimental shells, castings are made, which are examined for slag inclusions and shrinkage, and the gating and risering system is modified as necessary. From the modified pattern, more shells and castings are made. If, then, the castings are otherwise satisfactory, measurements are taken on them and the pattern is again altered so as to make it produce a casting which is about 0.003 in. oversize. The measurements compared must be those of the actual pattern and casting. Shell measurements must not be used since the shell shrinks about 0.004 in. per inch on removal from the pattern. After this modification, more castings are made and measured and finally, the pattern is altered to produce castings to the exact dimensions and limits required.

Thus the attainment of maximum accuracy with the shell-moulding process is a complicated procedure, though some of the above steps can be cut down if experienced personnel are available.

Dump-box Design

Effective operation of the dump box presents several problems of a purely mechanical nature quite apart from difficulties of resin segregation. Attention must be paid to the seal between pattern and dump box. Here, there are two requirements. The first is to provide a satisfactory seal, preventing the escape of fine sand, and the second is for a satisfactory separation between the uncured shell and dump box. This may be achieved by the use of a firm silicone-rubber material arranged as a gasket, together with the provision of a frame to surround the pattern. Ideally, the gasket should bear directly on the pattern without the introduction of shear. It should preferably be fastened mechanically to the dump box in a production operation, since this considerably simplifies any replacement that becomes necessary. The frame surrounding the pattern should stand about $\frac{1}{2}$ in. high and may be removed when the shell is stripped. A set-up such as that shown in Fig. 9 is appropriate.

Shell Moulding as a Production Operation

Shell moulding developed as a production operation presents many divergencies from small-scale practice. Much of the process of satisfactory shell moulding involves precision in engineering arrangements. These can often be much better achieved in a production operation where initial difficulties have been overcome and considerable attention has been paid to the engineering aspects of design, than in an experimental set-up.

Two types of machine generally used embody single stage and multi-stage operations. The former employs a pattern, generally electrically heated, which moves from a furnace at the back of the installation to a conveyor at the front where the dump box is situated. The pattern is preheated in the furnace, inverted, and then returned to the furnace for curing. This operation is necessarily slower than that of a multi-stage machine, though the single operator can generally be kept busy in setting cores and assembling moulds whilst the pattern is in the furnace.

In a multi-stage machine output is naturally somewhat larger than from the single-stage type. A disadvantage of the multi-stage operation, however, is that more patterns at one time are needed. Thus for satisfactory operation, multi-stage equip-

ment must be used for jobs where large numbers are needed. Also in some designs of this type, difficulty may be experienced due to the varying height of patterns. This may lead to pattern faces being at different heights from the top heating units, and consequently to non-uniformity in curing. Again, although shell production from a multi-stage machine may be large, joining the shells together to produce a mould is still a relatively slow operation, so that a single-stage machine in the end may be more convenient.

Future machines may involve induction curing, which seems to be an obvious development in shell-moulding technology. The method is at present being actively investigated and shows considerable promise. As an example, it has been reported that a shell $\frac{1}{8}$ in. thick may be obtained in 30 seconds with a 4-turn induction coil employing 550 amps at 440 volts and 60 cycles per second.

Cost Information

Cost comparisons are rather difficult, since no detailed figures have been published in America, and in any case costs would vary with the type of installation. Most of the meagre data available, and general opinions solicited, indicate that in America the cost of a casting for which about 300 moulds are required is about the same by sand and shell moulding, with a tendency for shell moulding to be the dearer.

An interesting study may be made using published British figures as a basis, with some adjustment to provide as direct a comparison as possible. Thus "overheads" have not been charged. In general, material and equipment for shell moulding cost about the same in America as in Britain, while wages are about three times as much across the Atlantic. Figures are thus presented on this basis, for U.K. and U.S.A., using sterling values, in Table I. It will be seen that: (a) In the U.S.A. for the shell mould, making costs 48 per cent. of the total direct cost, while in U.K. it is only 24 per cent. This shows clearly how mechanization of the process is much more important in the U.S.A. than here, and explains the trend of recent American developments. (b) For comparable operations shell moulds in the U.S.A. are cheaper than sand moulds, while in the U.K. the reverse is true. Cost differences, however, are not very large and are to some extent offset by increased yields obtainable for shell-moulded castings. Hence ordinarily the operation hinges on the value placed on the extra quality of casting, either dimensionally, in appearance, or in machine-shop evaluation, obtainable from shell moulds.

TABLE I.—*Comparative Costs* for Sand and Shell Moulds (on a Sterling Basis).*

	Operation time, min.	Hourly rate. U.K. s. d.	Hourly rate. U.S.A. s. d.	Cost. U.K. s. d.	Cost. U.S.A. s. d.
Sand Moulding.					
Preparation of cores	4	4 4	13 0	0 3½	0 10½
Preparation of mould	20	4 4	13 0	1 5	4 3
Total direct cost ..		..	.. ..	1 8½	5 1½
Shell Moulding					
Production of cores	3	3 8	11 0	0 2¼	0 6¾
Production of shells	4	3 8	11 0	0 3	0 9
Assembly of mould	3	3 8	11 0	0 2¼	0 6¾
Material costs ..	—	—	—	2 0	2 0
Total direct cost		..	.. ..	2 7½	3 10½

* These data ignore the raw-material cost of sand, but this is small in comparison with other costs.

Acknowledgments

The Author wishes to express his thanks for the generous help and hospitality afforded him by many American foundries during the preparation of this report. He would particularly like to acknowledge the assistance given by the International Harvester Company, and the Cooper Alloy Foundries.

Board Changes

VACUUM BRAKE COMPANY, LIMITED—Mr. A. P. W. Simon has resigned from the board.

HARLAND & WOLFF, LIMITED—Mr. James H. McCuaig, shipyard manager at Belfast, has been appointed to the board.

BRITISH AIR BRAKE COMPANY, LIMITED—Mr. H. J. Stretton has been appointed a director, and of Consolidated Brake & Engineering Company, Limited, and Timbrell & Wright (Successors), Limited.

POWELL DUFFRYN-COPPEE, LIMITED—Mr. Gaston Mostart, Mr. Peter Ewen, Mr. Philippe Le Hodey, Sir Henry Wilson Smith, Mr. G. W. Alexander, and Mr. K. A. Hogan have all been appointed directors.

BRITISH UNITED SHOE MACHINERY COMPANY, LIMITED —Mr. K. S. Gimson has relinquished his office of deputy managing director, but continues as deputy chairman. Mr. C. G Bennion, previously an assistant managing director, has been appointed deputy managing director. Mr. W. N. Bray and Mr. W. G. Jeffrey, both directors, have been appointed assistant managing directors. Mr. G. W. Holmes, a director, has been appointed to the additional office of general manager.

Churchill Gold Medallist

The Churchill Gold Medal of the Society of Engineers has been awarded to Sir William Wallace, chairman and managing director of Brown Bros. & Company, Limited, Edinburgh, for his part in bringing ship stabilizing gear into practical application. Sir William is patentee of the Denny-Brown ship stabilizer, which reduces rolling in rough sea, and has been fitted in the royal yacht Britannia. The award will be presented at the Society's centenary banquet next month.

The Churchill Gold Medal was instituted by the Society of Engineers to commemorate the close wartime association between engineers and Sir Winston Churchill, who is an honorary Fellow of the society. It is given every two years for the most noteworthy contribution to engineering, and was first awarded to Sir Frank Whittle, the jet pioneer.

Sir William, who is also a director of William Beardmore & Company, Limited, North British Rubber Company, Limited, and other companies, is a member of the Institution of Mechanical Engineers and of the Institution of Naval Architects. He has served as president of the Engineering and Allied Employers' National Federation and of the Institution of Engineers and Shipbuilders in Scotland.

Parliamentary

Coal and Steel Community

Replying to MRS. WHITE, who asked for a statement on the proposed closer association of the United Kingdom with the European Coal and Steel Community, MR. NUTTING, Under-Secretary of State for Foreign Affairs, said he had nothing to add to a reply given on March 3. He added that the Government had sent no reply to M. Monnet's proposals.

MR. H. MORRISON said that if M. Monnet's proposals were published the matter could be discussed in public by the various interests concerned, which would assist the Government and the House in making up their minds on the merit of the proposals. He asked: "Why should these proposals be kept so secret?"

MR. NUTTING said they were following the normal practice in these matters, and he could assure him that all the interests concerned, industrial, trade union, and so on, were being fully consulted at the moment. It was because of those consultations that there had been a rather longer interval than otherwise.

MR. MORRISON pointed out that the interests concerned had been consulted, but the Government declined to inform the House about the proposals.

MR. NUTTING said he was not being quite fair. The House would be fully and properly consulted when the Government had decided.

MR. JACK JONES said that in the meantime decisions were being taken within the Schuman Plan "to the tremendous disadvantage of our steel industry."

MR. NUTTING said that was a very good reason why all interested parties should be properly consulted.

Capital Investment in Fuel

MR. PALMER asked the Minister of Fuel and Power the total new capital investment of the nationalized coal, electricity, and gas industries since vesting date in each case, and corresponding figures for the period before the outbreak of war in 1939.

MR. LLOYD: "In round figures, £240,000,000, £810,000,000, and £205,000,000, respectively." The Minister said that corresponding figures of pre-war investment were not available for gas. For electricity, the figure for the six years before 1939 was about £200,000,000, which would be equivalent to a figure perhaps three times as great in present-day money.

When SIR HERBERT WILLIAMS asked why it was that the increased investments in the coal mines resulted in no material increase in output last year, MR. LLOYD said that was rather a different and larger question, but he would point out that it took up to 10 years to bring in a new pit and about seven years to complete a major reconstruction.

Loans for Industry

The average amount of loans recommended for industry from the Revolving Fund for Industry established with counterpart funds was about £10,000, said MR. PETER THORNEYCROFT, President of the Board of Trade. Thirty-two out of 321 applications, which had been received by the end of March, had been recommended by the advisory committee. He said that the loans recommended were subject to negotiation of the necessary agreements; those negotiations were in various stages and a few were approaching completion.

When MR. ALBU asked why the proportion of grants was so low, the MINISTER said that clearly there were many industries which might feel they might benefit from the facilities for borrowing money and it was right to concentrate on lending in those cases where a real advantage to productivity would result.

Extension to Patent Office Library

Immediate open access to over 3,500 scientific and technical periodicals in all languages has been provided by a new extension to the Patent Office Library which is now open to the public in the basement of the headquarters building in Chancery Lane, London. All of this periodical material, which ranges over the whole field of technical invention from agriculture to zinc, will now be conveniently arranged on open shelves. It will cover items, published since 1920. Hitherto much of it has only been available on request. Earlier volumes will continue to be supplied on demand.

Another important addition will be the provision of a special section for bibliographies and abstracts—indispensable keys to the searching of scientific literature. The extension has been made possible by a general rearrangement of the library and by overhauling the wartime accumulation of unbound volumes. These arrears have been reduced from 22,000 to 14,000 in the past three years and will be further reduced to 10,000 by the end of this year. The Patent Office Library, a reference institution of international repute, was established in the mid-nineteenth century, has a total stock of 360,000 volumes and is open to the public until 9 p.m. Monday to Friday, and until 5 p.m. on Saturday. It is visited by nearly 2,000 people a week.

Employers' Wage Offer Accepted

At a meeting at York, on April 8, the majority of the 39 unions affiliated to the Confederation of Shipbuilding and Engineering Unions accepted the recommendation of the Executive Committee of the confederation to accept the wage offer made by the employers on behalf of employees in the shipbuilding and engineering industries and railway workshops. The increases will cost about £50m. a year and range from 6s. 6d. a week for unskilled workers to 8s. 6d. for skilled workers. The increases are to come into effect this week in the case of engineering and shipbuilding, and with regard to the railwaymen, the flat-rate increases are retrospective to January 11 and will apply to overtime and Sunday payment as from March 1. By 97 votes to 35 an amendment was defeated asking the unions to approach the employers to obtain an improvement in the proposed rates for unskilled workers. It was moved by Mr. J. Matthews (National Union of General and Municipal Workers), who declared that the offer had been framed by the employers with a view to causing a rift between the skilled and the unskilled.

Longer Thermodynamics Course

The Thermodynamics School at Birmingham University, which was formed 2½ years ago, has now increased its course from nine months to a year, and has decided to award the degree of Master of Science to successful graduate students. The course is designed for men with practical experience and the aim of the course is to provide industry with a nucleus of first-rate engineers who can tackle any problem, however complex and advanced the techniques. Research, as such, plays no part in the curriculum. While the two principal subjects of the school are thermodynamics and gas dynamics, there are five subsidiary courses on dynamics of machines, elasticity of materials, instrumentation, mathematics and oil-engine practice. Professor Frank K. Bannister is in charge of the school under Professor G. F. Mucklow, Head of the Department of Mechanical Engineering.

New Instruments for the Iron and Steel Industry

Equipment shown at Physical Society Exhibition

Among the varied and ingenious instruments shown at the Physical Society exhibition in London, which closed last week, were some with definite applications of interest to the foundry and the iron and steel industry generally, while not necessarily being designed to this end. A survey of some of the instruments shown is given below; they include instruments for examining the inside of melting furnaces while in operation, a metal-level indicator, a special microscope and applications of industrial television and radioactive isotypes.

Space restriction was even more severe at this year's Physical Society exhibition held at Imperial College, London, from April 8 to 13. However, the high technical quality of exhibits was maintained, and many new units were on show at this well-attended event. Certain techniques were designed for use in the iron and steel industry; others could be adapted for this purpose or for foundry purposes. A review of such instruments follows.

Instruments for Open-hearth Steel Furnaces

A furnace scanning periscope for investigating temperature distribution over the roof of an open-hearth furnace was one of B.I.S.R.A's. exhibits. Water cooling is used on this instrument, which limits the size of entrance aperture to a minimum. To obtain the necessary coverage from 0 to 120 deg. from the horizontal, a reflecting head unit is used with a concave mirror and a partially reflecting plate. The field of view switched to three different positions using three small entrance apertures, covering the 120 deg. required, by rotating the reflector plate. A conventional optical system then presents the image to the eye or camera at the other end of the instrument. Each zone of view subtends an angle of about 50 deg. The resolving power in the centre of the zone is approx. 5 min. of arc.

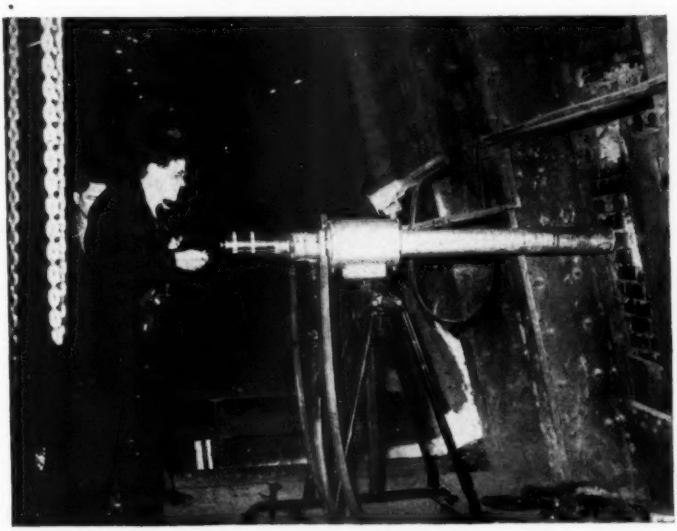
The periscope, inserted horizontally into the furnace, may be rotated about its axis. This together with rotation of the reflector plate, allows any point in the furnace to be viewed. Fig. 1 is an illustration of the periscope in use.

Another instrument shown for use chiefly with open-hearth furnaces is a two-image pyrometer. This has been designed because measurement of the total emissivity of flames requires two separate radiation measurements to be made; one of the flame radiation and one of the combined radiation of the flame and a background source, this latter radiation being controlled or known. A mirror-reflecting off-axis type total radiation pyrometer has been adapted to do this; the thermopile receiving the reflected energy has two separate junctions or groups of junctions with their own limiting diaphragms, each situated to receive its own image from the appropriate source. The junctions are connected to separate channels of a multipoint recorder and thus very nearly simultaneous measurement is achieved without the inconvenience of having to move the pyrometer or obstruct the background energy.

Study of Metal Surfaces

The use of electrical eddy currents for the study of metal surfaces was also demonstrated on the

FIG. 1.—*The B.I.S.R.A. open-hearth furnace periscope being inserted into the back of a furnace.*



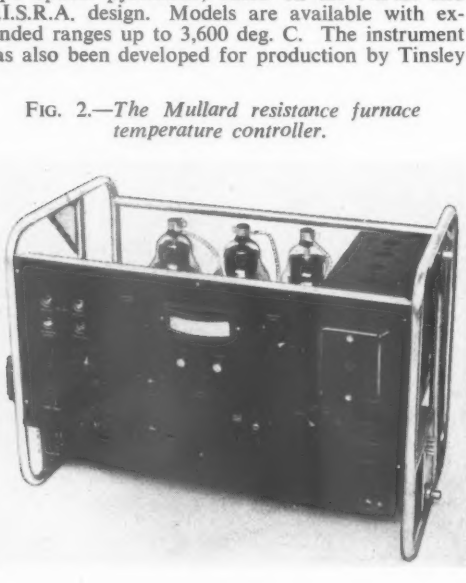
B.I.S.R.A. stand. Electrical eddy currents induced in a conductor by an alternating magnetic field are confined to the surface layers. The magnitude of the currents and the depth of penetration below the surface depend on the resistivity and permeability of the conductor, the frequency of the applied field and the disposition of the conductor in the field. When the source of magnetic field is a coil, the shielding effect of the eddy currents produces a modification in the impedance of the coil, measurement of which yields information on surface conditions. This provides a means by which any surface phenomena which cause change in resistivity or permeability can be studied. This technique is being used in the measurement of very thin coatings on steel sheet (*e.g.*, 0-0.0005 in. of tin) and an attempt is being made to use it to investigate the depth of hardness in steel.

Thickness Gauge

Another type of gauge to measure the thickness of non-magnetic coatings such as paints or platings on ferrous bases was exhibited by Evershed & Vignoles, Limited. It is manufactured by Tinsley (Industrial Instruments) Limited. It consists of a specially light magnet attached to a spring and contained within a pencil-like tube. To take a measurement, the magnet is placed on the testing surface and the body of the gauge is drawn away thus extending the spring. The spring extension, the amount of which is observed on the scale, is proportional to the force required to detach the magnet from the surface. A layer of the non-magnetic material such as paint between the magnet and the ferrous base, decreases this force and hence the spring extension will be a measurement of the thickness of the layer.

Also on this stand was the disappearing filament type optical pyrometer, based on the N.P.L. and B.I.S.R.A. design. Models are available with extended ranges up to 3,600 deg. C. The instrument has also been developed for production by Tinsley (Industrial Instruments), Limited, by whom it is now manufactured under licence.

FIG. 2.—*The Mullard resistance furnace temperature controller.*



Furnace Temperature Controller

Mullard, Limited, demonstrated how the temperature of a small resistance furnace could be controlled to better than ± 0.2 deg. C. by a signal derived from a thermocouple unit. The required temperature (up to 1,100 deg. C.) is set by means of a potentiometer calibrated directly in millivolts, and the power to the furnace is regulated by means of thyratrons. Provision is made for proportional, differential, and integral terms. When the "programme unit" is employed, the required furnace temperature is coded and punched on to a paper tape. The equipment translates this and compares it with a reference signal from the thermocouple in the furnace. The resulting error signal is fed into the temperature controller in the normal way, thus enabling temperatures up to 1,000 deg. C. to be programmed for short or long periods in steps of 1 deg. C. The instrument is shown in Fig. 2.

Ultrasonic Cleaning

The application of standard Mullard ultrasonic equipment to cleaning problems was also demonstrated. The activity of a cleaning bath is greatly increased by irradiation with ultrasonic vibrations. When the contaminant consists of an adherent film (as is the case when cleaning optical lenses), the frequency used is 25kc. per sec., obtained from a magnetostrictor. If, on the other hand, the problem is to remove loosely-held particles from inaccessible places (as is the case when cleaning ball races and similar components), frequencies of the order of 1Mc. per sec. are employed, obtained from a quartz crystal transducer. Precision parts may be cleaned by these methods.

Another Mullard unit was a high-power ultrasonic drill for machining brittle materials. This consists of a reciprocating tool operated at an ultrasonic frequency. A high Q magnetostriction transducer is used to generate vibrations of 15 kc. per sec., which are transmitted *via* a tapered metal stub, acting as a step-up velocity transformer, to a tool tip screwed into the end. The amplitudes obtained are large enough to allow comparatively rapid sinking and penetrating of extremely hard, brittle materials such as tungsten carbide, when a paste of abrasive is fed to the tool tip. The hole produced is of any shape which can be formed on a mild-steel tip, the maximum lateral dimension of which is 2 in.

Emission from Worked Surfaces

The Mechanical Engineering Research Laboratory of East Kilbride, Glasgow (D.S.I.R.), showed an exhibit illustrating emission from worked surfaces. Freshly abraded surfaces (and evaporated films) of certain metals, such as aluminium, zinc or cadmium, when placed under an open-ended Geiger-Müller counter, and illuminated with light of a definite wavelength within the visible range, emit negatively charged particles which trigger the counter and are recorded as pulses on an oscilloscope and scaler. It is believed that electrons are liberated from electron traps, probably negative ion vacancies (F-centres),

present in the surface oxide, by the action of light and thermal agitation. In the presence of oxygen, oxygen molecule ions (O_2^-) are formed, which by means of a positively charged grid are directed into the counter. The phenomenon can also be recorded photographically; and such records were shown of cleaved single crystals of zinc, which, only when abraded, produce an image.

Load Cells

Load cells provide a new means of measuring forces ranging from 5 cwt. to 200 tons. The force to be measured is caused to stress a high-tensile steel member carrying bonded resistance-wire strain gauges connected as a bridge circuit. The load-carrying member is housed in a hermetically sealed cylindrical container provided with a cable entry gland. The bridge is excited from a low voltage source, and provides an out-of-balance signal of 2 mv. per volt input to the bridge for capacity load. The out-of-balance signal is linear in relationship with the applied load.

Load cells are self-compensating for temperature variations. The present range for compressive loading includes maximum ratings of ½ ton, 2½, 15, 50, and 200 tons. The physical dimensions vary according to ratings with an average diameter and height of approximately 4 in. The advantages of the load cell system of force measurement are:—(*a*) Absence of moving parts; (*b*) suitability for use in all atmospheric conditions; (*c*) suitability for remote indication or recording. Typical applications include measurements of roller pressures in calenders and rolling mills; measurement of pressure in rams, presses, etc.; tank weighing; batch weighing and control; axle loads; thrust measurements; remote indication, recording and control. These units were shown by Elliott Bros. (London), Limited.

Liquid Level Gauge

A means whereby the level of liquid metal in a furnace can be detected from the outside is being developed by Isotope Developments, Limited. A liquid level gauge operating on the principle of gamma-ray absorption can be made to measure or control height of liquid glass or metal. This technique has many potentialities, and would be most useful for blast-furnace work, and on other equipment where visual and other aids are strictly limited.

Turbine Blade-edge Microscope

Taylor, Taylor & Hobson, Limited, showed a turbine blade-edge microscope. This instrument provides a means for critically viewing the shape of the leading and trailing edges of turbine blades. In the workshop, it should help operators to avoid scrap. The microscope can be used in full daylight. Any part of the edge can be viewed to within ⅛ in. from the root or shroud. Blades up to 2½ in. wide, and as long as desired, can be handled. The field of view at the blade edge is 0.18 in. dia. The shape of the blade edge is seen at a magnification of × 40. A narrow band of light is projected obliquely round the edge of the blade to delineate the section. This is viewed obliquely through the microscope. The image seen through the eyepiece is that of the normal cross section of the blade. The observed shape is compared with a master drawing prepared at × 20 size on a card 3¼ in. × 4¼ in., the card being slipped into a holder on the instrument. The card is seen through the eyepiece of × 2 magnification (making × 40 in all). Blades up to about 8 in. long are held against a V fitting by means of a spring plunger.

Industrial Television

Electrical and Musical Industries, Limited, has recently developed a television equipment providing a means of observing one or any number of objects or operations, in any position, at any distance, and simultaneously in any number of places. Under restricted physical conditions, it may act as a substitute for the human eye. The practical use of this comparatively inexpensive equipment will cover a wide range of industrial applications. The small camera may be placed in inaccessible positions or used to watch processes involving high temperatures or personal danger.

The equipment may also be used in many fields outside industry, especially in commercial work, education and training. For example, students in a large class may be brought, in effect, to within inches of an object being demonstrated without moving from their seats. Offices, libraries, and banks can check written and printed matter over considerable distances. Although at present this equipment is limited to special applications, it may well become as familiar as the telephone is to-day.

Robustly constructed, the equipment is designed to operate for many hours under rigorous conditions, without attention. No light control adjustment is necessary, unless there is a considerable change in illumination. On varying scenes, operation is simple and may be carried out by non-technical personnel. The camera and control panel are divided into small sub-units which may easily be replaced for maintenance. Standard type receiver valves and components are used throughout. The whole equipment is self-contained and powered from the normal mains supply.

J. Langham Thompson, Limited, also showed closed-circuit industrial television equipment.

Radioactive Isotope Containers

The Newton Victor range of radioactive isotope containers was shown. They embody new features concerned with the safety of the operator. The containers are so designed that the intensity of radiation from the radioactive source is reduced, by built-in protective screening, below the tolerance dose at the surface of the container—it is safe to touch or handle the container for any period up to 40 hrs. per week. Further, the source may be attached either to a rigid rod or flexible cable, and remain so attached, both for radiography of individual specimens and for panoramic work. The need to extract the source from the container and to carry it to the radiographic position—exposing the operator to the risk of harmful radiation in the process—is thus eliminated. A remote control device can be provided if required.

Foremen's Training Course

Sixth Annual Gathering at Ashorne Hill

During a week-end early this month, one of the most successful functions of the Institute of British Foundrymen—the Foremen's Training Course—was held once again at Ashorne Hill. This was the sixth year running that the Course had been held, and that the interest has in no way diminished was shown by the numbers attending, nearly 200 delegates (a "full-house") being registered. The Course was well supported, too, by past-presidents and other men of long standing in the Institute. It is, in fact, this close sequestration in the conference hall, at the dining tables, and in the lounges at Ashorne Hill, between the foremen and senior executives of the Institute and industry which contributes much to the undoubted success of the gatherings. Here, the men who have to solve the day-to-day problems of the foundry at shop-floor level have the opportunity of full exchange of views with those responsible with directing activities, and a worth-while two-way traffic results.

Following assembly on Thursday afternoon, the evening was taken up with a film show at which four were exhibited—"The Invisible Shield," an American film about ventilation featuring the Studebaker concern; "Mechanization in America," a film prepared under the auspices of the American Foundrymen's Society; "Lloyds Nowadays," about the British steel foundry of that name, and "Modern Malleable," an American film extolling the virtues of that material.

Friday Morning

The proceedings began on Friday morning with an address by the president of the Institute, Mr. E. Longden, M.I.MECH.E., in which he emphasized the value of methods records in a foundry, and showed a few slides to illustrate in particular how contraction rules could be applied to various shapes and sizes of castings.

Next followed a Paper on shell moulding by Dr. P. R. Beeley, foundry manager of Sheepbridge Steel Castings, Limited. Dealing first with the introduction and extensive adoption of the shell-moulding process, he next gave an outline of the main principles, with descriptions of some of the production techniques which are finding application in this field. Some reference was made to the various mechanical and other aids to production, but emphasis was laid upon the fundamentals involved in the process, the effects of the commonest variables and their impact upon the design of equipment and upon the materials and techniques employed. The sphere occupied by shell moulding in relation to the foundry industry as a whole was discussed. Suggestions were advanced as to probable future developments and the view expressed that, although some of these developments would in the earlier stages be at the expense of present casting production, it was thought the major expansion would be at the expense of other methods of manufacture, and would thus enlarge the overall field of usage of castings.

Unfortunately, no time was left for discussion and, after a break for "elevenses," the programme was resumed with a Paper, "Influence of Equipment on the Productivity of the General Foundry," by J. Blakiston (consulting foundry engineer). For this Mr. P. H. Wilson occupied the chair. The first part of the lecture dealt with the development of mechanization from the turn of the century up to the pre-war period. This was followed by a brief *résumé* of the major wartime foundry mechanization projects. Post-war foundry developments in regard to mechanization and mechanical aids were then reviewed with reference to the increase of capital and labour costs related to the economics of the industry, at the same time taking into consideration the practical aspects and repercussions on the individual operator. The later part of the lecture emphasized the necessity of obtaining the maximum production from all new capital equipment in order to justify its installation. Reference was made to cost of equipment and a four-figure investment per ton of castings per week was quoted as quite a normal expenditure on full mechanization. The figure of £800 was quoted for a small sand-reconditioning unit to serve a pair of moulding machines. After a short discussion on points of detail during which Mr. Blakiston reiterated the need for *fluid* mechanization, the chairman summed up and pointed out the foremen's responsibility to suggest to their managers ways and means for improvement.

After the luncheon interval, the Course sessions recommenced with Mr. J. Gardom presiding, and the Paper "Collaboration necessary from all Ranks in the Search for Improved Productivity," by J. Goffart (*ingénieur chef de service*, Société Anonyme John Cockerill), was admirably delivered by Mr. J. Foulon, director of the *Association Technique de Fonderie de Belgique*. Despite the fact that he spoke a language other than his own, his graphic delivery made up for any deficiency in vocabulary, and it was soon clear that his audience was completely with him. He had the difficult task of putting over the seemingly obvious theme that progress in foundry technique, human relations and day-to-day problems could be made by self-examination through the medium of providing answers to established lists of questions. An executive posing these to himself could logically derive a solution or at least enumerate the variables to be eliminated. The Paper emphasized that productivity was of extreme importance at the workman's level and advocated means of increasing this by qualitative measures. Precepts enunciated were that a foreman should (1) be receptive of ideas (2) assume an abstract or spectator view even of habitual processes, so as to visualize an external state of affairs, and (3) conduct a self-examination by means of the questionnaire mentioned.

For everyone to reach that state of mind where real pleasure could be got from improvement as opposed to problematical monetary gain, was to attain productivity mindedness. It was important to make the improvement seem to come from within a person rather than forced upon him by external agencies.

Discussion Groups

On Friday afternoon the delegates divided into chosen discussion groups, one on each of the following topics:—"Shell Moulding" (about 50 per cent. of the attendance); "Influence of Equipment on the Productivity of the General Foundry," and "Collaboration Necessary from all Ranks in the Search for Improved Productivity" (25 per cent. each). In these sessions free comment was passed on a broad interpretation, and the lecturers—Dr. Beeley, Mr. Blakiston and Mr. Foulon respectively—replied as needed to questions posed.

Saturday Morning

Dr. C. J. Dadswell, immediate past-president of the Institute, took the chair for the final session of the Course on the Saturday morning. The first Paper was by Mr. P. Millington, foundries planning engineer, Metro-

(*Continued on facing page*)

Personal

MR. HARRY COOK, chief electrician at North Skelton (Yorks) ironstone mine, for 20 years, has retired after spending all his working life of 50 years in mining.

MR. M. LOGAN, director of the British Internal Combustion Engine Manufacturers' Association, is to visit Sweden to study market conditions there on behalf of the industry.

DR. R. F. GOLDSTEIN, formerly development manager of chemical products for the British Oxygen Company, Limited, has been appointed general manager of the chemicals division of the company.

MR. J. A. BROOKS, who has been appointed superintendent of the motor department of Metropolitan-Vickers Electrical Company, Limited, has been superintendent of the company's Leonard Works since 1952.

MR. JOHN M. SOWRY, who was deputy manager of the Stafford works of the English Electric Company, Limited, has been appointed executive assistant to Mr. H. B. Style, president of the John Inglis Company and of the English Electric Company of Canada.

THE PRESIDENT-ELECT of the Sheffield Branch of the Institute of British Foundrymen is MR. E. AYRES, foundry manager, Millspaugh, Limited. The election breaks with tradition as for the first time in the history of the Branch a non-ferrous foundryman has been elected to this office.

AT LAST MONTH'S meeting of the National Ironfounding Employers' Federation, Mr. T. Lee retired from the presidency and was succeeded by Mr. A. D. Mackenzie, of Mackenzie & Moncur, Limited. This change creates a precedent as Mr. Mackenzie is the first president of the Federation from "north of the Border."

MR. J. F. PRINCE, export sales, and MR. A. E. TAYLOR, home sales, have been appointed deputies to Mr. T. G. Travis, sales manager at the Witton engineering works, Birmingham, of the General Electric Company, Limited. Mr. Prince was formerly in charge of plant export sales, and Mr. Taylor was assistant manager for Scotland.

MR. H. H. MULLENS, chairman of the North-Eastern Electricity Board since November, 1947, is to join the board of A. Reyrolle & Company, Limited, electrical engineers and manufacturers. of Hebburn-on-Tyne, as managing director on June 1. He was formerly with the North-Eastern Electric Supply Company from 1924, becoming deputy general manager.

SIR PERCY MILLS and MR. W. F. C. SCHAAP, the chief engineer of Babcock & Wilcox, Limited, have been appointed to the company's Board. LT.-COL. P. D. IONIDES has resigned from the Board after 26 years' service. Sir Percy, who is 64, is vice-chairman and managing director of W. & T. Avery, Limited, and a director of Textile Machinery Makers, Limited.

MR. W. GOSS, founder and managing director of Pattern and Model Manufacturing Company, Limited, Coventry, has died. His firm was responsible in wartime for producing patterns for Rolls Royce air-cooled aircraft engines. Mr. Goss was active, too, in organizing co-operative action among patternmakers in his area, and it is sad to record his death just when such activity has come to fruition on a national basis.

MR. S. MCCRACKEN, previously manager of the Belfast sub-office of Metropolitan-Vickers Electrical Company, Limited, has been appointed a director of Metropolitan-Vickers South Africa (Pty.), Limited. He has been with the company for nearly 40 years. He was appointed sales engineer at Belfast in 1934 and became manager there in 1950. Mr. McCracken's successor as manager of the Belfast sub-office is MR. F. W. COX, who joined Metropolitan-Vickers in 1935. After obtaining manufacturing experience in the instrument and meter department, he spent several years in the drawing office and design sections of the motor engineering department. In 1945 he joined the general engineering department and in 1948 was appointed senior textile engineer.

Obituary

MR. PERCY ELLIN BEARDSHAW, grandson of Mr. Joseph Beardshaw, who built up the firm of J. Beardshaw & Son, Limited, Baltic Steel Works, Attercliffe, Sheffield, has died at the age of 75. He worked as a young man with the firm and, though retiring from it in 1921, retained a financial interest in the business.

MR. CHARLES COOKE, managing director of Charles Cooke, Limited, Mettham Street, Nottingham, has died at the age of 72. His father founded the firm in the 1870's when it specialized in well-boring and lace machines. It is now manufacturing Mr. Cooke's own patent heavy duty winches for a tractor firm.

BRITISH INSULATED CALLENDER'S CONSTRUCTION COMPANY, LIMITED, announce with deep regret the death of Mr. L. E. White, in his 56th year. Mr. White joined the old Callender Company as a pupil apprentice in 1915 and, after service in many parts of the United Kingdom, was, at the time of his death, district engineer at the Erith contracts office.

Foremen's Training Course

(*Continued from facing page*)

politan-Vickers Electrical Company, Limited, entitled "Elimination of Fettling-shop Congestion." He presented numerous before-and-after pictures of the firm's fettling arrangements, consequent upon the need for coping with higher output, better housekeeping, improved handling and treatment methods and work segregation. Regarded in abstract, the Paper was an ideal practical extrapolation of the precepts enunciated in Mr. Goffart's exposition on the previous day, for each improvement Mr. Millington showed to be the result of answers to such questions as: "How can we process more in a given area?" "Are our handling methods logical?" "Can such-and-such an operation be mechanized?" and so on. In summation, the Author well interpreted his own variation of the Lancashire tag, "Where tha's muck tha's money" to be "Where tha's muck tha's *money lost*."

Mr. John Bell presided for the last Paper of the conference, which was admirably delivered by J. H. Pearce, A.I.MECH.E., technical representative (castings), English Steel Corporation, Limited. It concerned methods of control in the production of large castings and, after brief historical notes, dealt largely stage-by-stage with the making of the 185-ton forging press head, one of the largest steel castings ever to be poured in this country. Few of his listeners could ever be expected to have to produce such monsters, but the methods and tackle adaptation by which such a project was brought to success were an object lesson to all.

At its conclusion, Mr. Longden briefly summed up the Course and thanked the Authors, the organizers and all who had participated in discussions. The present writer's own comment is that seldom has he witnessed a body of delegates so appreciative of the efforts made for their aid or so enthusiastic about steps to be taken for the advancement of the industry as were the foremen at this gathering. That in itself is good augury for future Courses and foundry progress both.

News in Brief

THE ANNUAL CONFERENCE of the Combustion Engineering Association will be held at the Grand Hotel, Harrogate, on May 6 and 7.

THE LONDON ADDRESS of Shelton Iron, Steel & Coal Company, Limited, is now St. Ermins, Caxton Street, Westminster, S.W.1 (telephone: ABBey 5244).

REVISED figures show that Italy's production of crude steel was raised from 2,125,000 tons in 1948 to 3,500,000 tons in 1952-53, an increase of 65 per cent.

MR. R. A. YOUNG has been appointed manager of the Birmingham office of Martonair, Limited, at 75, Holyhead Road, Handsworth, Birmingham (tel.: NORthern 7273).

ELEVEN MEN, who, between them, have worked for the Patent Shaft & Axletree Company, Limited, Wednesbury (Staffs), for 601 years, have received long-service awards.

BLAST-FURNACEMEN employed by members of the Midland Merchant Blast Furnace Owners' Association are to get 18 days' annual holiday under an industrial court award announced on April 12.

MACHINERY and machine tools are among the goods displayed by British firms at Japan's first international trade fair, which opened at Osaka recently. Sixteen nations are represented at the fair.

THE GENERAL ELECTRIC COMPANY, LIMITED, announces that Mr. J. F. Prince, export sales, and Mr. A. E. Taylor, home sales, have been appointed deputies to Mr. T. G. Travis, sales manager of the Witton Engineering Works.

DERBY TOWN COUNCIL has approved a recommendation that the Special Purposes Committee should be asked to consider the inclusion of powers to establish smokeless zones in the borough in any General Powers Bill that might be promoted.

CHAMBERS BROS., LIMITED, ganister and refractory manufacturers, of Stoke Street, Sheffield, have appointed three new directors—Mr. E. J. Crawley, to be technical director; Mr. C. R. Hutcheson, sales director; and Mr. J. Burkin, production director.

MR. J. PARKER on April 9 presented long service awards and certificates to 17 employees of the Bradford works of the English Electric Company, Limited. The awards took the form of cheques for £50 and £25 for 50 and 40 years' service respectively.

FIELD MARSHAL, THE VISCOUNT MONTGOMERY OF ALAMEIN, K.G., G.C.B., D.S.O., will open the new foundry building of Guest, Keen and Nettlefolds (Cwmbran), Limited, on May 11. It is to be used for the production of motor-car cylinder-blocks and -heads.

E. C. PAYTER & COMPANY, LIMITED, Meeting Street, Great Bridge, Tipton, Staffordshire, have introduced a new range of 45- and 40-gall. light-alloy (Mg/Al) storage drums, fabricated from sheets of 14 or 16 gauge material, automatically welded, without flux, using an inert-gas-shrouded arc.

MORE THAN 600 STUDENTS attended a week's series of lectures on Diesel engines at the Technical College, Nottingham, which was organized by F. Perkins, Limited, of Peterborough. Six illustrated lectures showed the manufacture, servicing and operating of these engines.

THE FORMATION of the Welsh Economic Development Council was unanimously approved in Cardiff by a conference including industrialists, trade unionists, and local authorities. The council's constitution will now be drafted by the provisional committee selected by the conference.

ABOUT 60 MEMBERS of the Derby section of the Institution of Production Engineers attended a lecture on "Ferrous Die-castings," which was given by Mr. H. A. Redshaw, general manager of the die-casting division at Qualcast, Limited, Derby. The lecture was illustrated with lantern slides.

THE EASTERN REGION of British Railways has placed a contract with John Brown (Clydebank), Limited, for a new train ferry for the Harwich-Zeebrugge service. The introduction of the new vessel, which will cost more than £600,000, is expected to cut operating costs by £20,000 a year.

ON APRIL 10, Mr. J. Whitehead, general manager of the David Brown Tractor Group and president of the David Brown Tractor Sports Club, Huddersfield, performed the opening ceremony at the club of a new bowling green, which has been built on spare land adjoining Meltham Hall.

CONSTRUCTION is to begin shortly of a new 715-ft. dry dock, capable of accommodating tankers of up to 45,000 tons dw., for Swan, Hunter & Wigham Richardson, Limited, the Tyneside shipbuilders. The new dock, which will take something over two years to complete, will adjoin the company's Neptune yard.

MR. WILLIAM SKELTON, a 38-year-old foundry employee, was killed in Denny Ironworks on April 10 by a falling two-ton oxygen cylinder. Mr. Skelton was moving the cylinder by block and tackle. The chain on the tackle slipped and the cylinder fell on him, crushing him against a wall. He died almost instantly.

THE WISHAW FIRM of R. Y. Pickering & Company, Limited, wagon and rolling stock builders, has received an order for the construction of 2,700 steel wagons for the British Transport Commission. The order which will take 2½ years to complete is valued at £750,000, and the wagons are of the 16-ton standard mineral type.

A PARENTS' DAY held by the Derby Works of International Combustion, Limited, early this month, was attended by over 300 relatives and friends of the 180 boys in the apprentice training scheme. The visitors were shown round the various workshops and encouraged to talk to the boys and ask questions. An exhibition of the apprentices' work was also arranged.

A FIVE-DAY COURSE at the Davy & United Engineering Company, Limited, Sheffield, during Easter week was attended by eight public schoolboys who are working at the firm. The boys are from Tunbridge Wells, Oundle and Repton, and average 17 years old. It is hoped that some may decide to join the firm, which has more than 50 former grammar-school boys among its student apprentices.

IN EXCHANGE for 397,300 of its ordinary shares, English China Clays, Limited, has provisionally contracted to acquire from H. D. Pochin & Company, Limited, and its associated company, Wheal Remfry, China Clay, Brick & Tile Company, Limited, the 470,663 ordinary shares of English Clays Lovering Pochin & Company, Limited, not already owned by the company.

GERMAN steel production in March amounted to 1,362,000 tons, against 1,207,000 tons in February, representing a daily increase of 247 tons. Output of

News in Brief

pig-iron totalled 964,000 tons, compared with 844,000 tons in February, the daily rise being 933 tons. Steel output in the first quarter, however, was 3,870,000 tons, compared with 4,286,000 tons in the corresponding period of last year.

GUESTS at Sheffield's Cutlers' Feast toured for two hours the following day Firth Brown Tools, Limited, and Thos. Firth and John Brown, Limited, steelmakers and forgemasters. They included the Controller of the Navy, Vice-Admiral Sir Ralph Edwards. At the former they were welcomed by the managing director, Mr. Eric Mensforth, and at the latter by the managing director, Dr. Charles Sykes.

THE BRITISH WELDING RESEARCH ASSOCIATION has appointed Mr. A. G. Thompson, B.SC., A.M.I.C.E., to make an investigation into welding productivity. Mr. Thompson has been associated with the welding and metal fabricating industries for a number of years and has recently been engaged in investigations into product design and production problems with a group of companies in the heavy engineering industry.

AN EXHIBITION, arranged jointly by Glasgow Corporation libraries and the Department of Scientific and Industrial Research, illustrating the uses of the public library in connection with local industry was opened in Glasgow recently. The exhibition shows how the local public library can obtain for industrialists, technologists, students and others, published information on almost any industrial subject.

SOUTH AFRICAN steel prices have been lowered by an average of 20s. per ton of "Iscor "production. The Minister for Economic Affairs said that this would mean a reduction in primary steel prices amounting in all to about £1,000,000. The price of galvanized sheets for building would be cut 15s. to 25s. per ton. In cases where certain types of steel were reduced at the end of last year, however, there would be no further cut now.

THOMAS HOLCROFT & SONS, LIMITED, iron and non-ferrous founders, of Bilston (Staffs), a firm which admitted 11 charges relating to the purchase of 389 tons of scrap iron at prices in excess of the control price, was fined £110 and ordered to pay the costs of the prosecution at Stafford Quarter Sessions. It was stated that the company was in a "desperate" state for scrap and was faced with closing altogether or working such short time that it could not expect its 160 workmen to remain.

TWO BRITISH FIRMS have signed an agreement with the Turkish Government for the construction of a dam and power station at a cost of £12,000,000. The building of a 280-ft. high rockfill dam and adjacent power station at Hirfnli, about 65 miles south-east of Ankara, is to be undertaken by George Wimpey & Company, Limited. Permanent generating plant, transformers, and switchgear for the station, which will be capable of generating 100,000 kw., will be supplied by the English Electric Company, Limited.

UNITED STEEL COMPANIES, LIMITED, of Sheffield, have sold the Nostell Brick and Tile Works near Wakefield, and they have now returned to the family of the Hon. Rowland D. G. Winn, which had owned them for over a century. The business left the family on the nationalization of the steel industry in 1951 and the work has been continued by the Nostell Colliery, Limited. A new company, The Nostell Brick & Tile Company, Limited, with a nominal capital of £50,000 in £1 shares, has been formed to take over the business with members of the Winn family as directors.

A CLERGYMAN is working at the bench in the Willenhall works of C. & L. Hill, Limited, non-ferrous founders. He is the Rev. David Wood, a clergyman of the Church of England, who is industrial chaplain to the Rubery Owen Organization, to which the firm belongs. Mr. Wood, who undertook the work owing to a labour shortage, has been doing a normal turn from 7.30 a.m. to 5 p.m. Before going to work he has been taking a 6.45 a.m. service at a Wolverhampton church, and in the evening has been conducting Lent services at another church. What he earns as a filer will go to church funds.

REFERRING to the discussion in March on the incidence of industrial diseases among local foundry workers, Coun. Mrs. M. Evitts told a meeting of West Bromwich Health Executive Council on April 9 that the Health Committee had since received a letter from the Local Advisory Committee of the Ministry of National Insurance asking if the Medical Officer of Health or the Committee itself had any recommendations to make. Mrs. Evitts said that the manufacturers had been approached for their co-operation in a survey of the position concerning pneumoconiosis in West Bromwich foundries, and it is hoped to reopen the matter again shortly.

TRADE WITH RUSSIA afforded "great openings" for the British manufacturer provided that he could offer goods which the Russians required, Mr. A. N. Jackson told a meeting of the Birmingham Junior Chamber of Commerce. Mr. Jackson recently spent three weeks in Moscow as a member of a British business men's mission. Any manufacturer who thought that his products would interest the Russians should first consult the Board of Trade to ascertain if those goods could be exported to Russia. Then he should approach the Soviet Trade Delegation in Britain which, if it was interested in the product, would make contact with the All-Union Chamber of Commerce in Moscow.

EDGAR ALLEN & COMPANY, LIMITED. have opened a new cafeteria at their Sheepcote Lane Works, Sheffield. It has seating for more than 200 in the main hall and a senior staff dining room seating 24. A flower garden and lawn is provided at the entrance. The structure is of concrete with brick walls, flooring is of thermo-plastic tiles, and natural lighting is used. Amenities include upholstered tubular furniture, hanging flower baskets and growing palms. The foundrymen have nicknamed the cafeteria "palm lounge." The building has taken five months to complete. The first man to be served was given a free meal, presented by the chairman of the company. He was Mr. George Andrews, a machine man, who completed 50 years with the firm on April 8.

CRITICISMS of industrial training schemes based in many cases on "time and motion study" were made by Sir Frederic C. Bartlett, Professor of Experimental Psychology at Cambridge University, when he gave the closing address at the three-day annual conference of the Ergonomics Research Society, at Ashorne Hill on April 7. Saying that he believed most industrialists found human relations their most intractable problem, Sir Frederic said ergonomists should start work on this sort of problem. He suggested that a perfectly practicable experiment would be a test to find out what he called "responsibility ceiling." Modern society tended to produce a lack of incentives or motives, and people were unwilling to take responsibility above a certain level.

Pig-iron and Steel Production

Statistical Summary of February Returns

The following particulars of pig-iron and steel produced in Great Britain are from statistics issued by the British Iron and Steel Federation. Table I summarizes activity during the previous six months. Table II gives production of steel ingots and castings in February, and Table III, deliveries of finished steel in January, 1954. Table IV gives the production of pig-iron and ferro-alloys in February, 1954, and furnaces in blast. (All figures weekly averages in thousands of tons.)

TABLE I.—*General Summary of Pig-iron and Steel Production.*

Period.	Iron-ore production	Imported ore consumed.	Coke receipts by blast-furnace owners.	Output of pig-iron and ferro-alloys.	Scrap used in steel-making.	Steel (incl. alloy). Imports.[1]	Output of ingots and castings.	Deliveries of finished steel.	Stocks.[2]
1952[3]	306	190	228	202	171	29	310	252	739
1953	304	207	237	215	188	18	339	261	1,011
1953—September[4]	292	215	232	214	196	14	347	272	1,016
October	288	226	237	222	202	12	355	280	986
November	292	232	245	229	206	15	363	283	994
December[4]	297	229	244	225	192	12	339	256	1,011
1954—January	307	234	246	230	203	10	360	275	989
February	302	230	240	222	201	14	357	—	947

TABLE II.—*Weekly Average Production of Steel Ingots and Castings in February*, 1954.

District.	Open-hearth. Acid.	Open-hearth. Basic.	Bessemer.	Electric.	All other.	Total. Ingots.	Total. Castings.	Total ingots and castings.
Derby, Leics., Notts., Northants and Essex	—	3.5	8.7 (basic)	1.8	0.2	13.1	1.1	14.2
Lancs. (excl. N.W. Coast), Denbigh, Flints and Cheshire; Yorkshire (excl. N.E. Coast and Sheffield)	2.0	27.0	—	1.6	0.7	30.1	1.2	31.3
Lincolnshire	—	37.2	—	—	0.1	37.2	0.1	37.3
North-East Coast	2.3	68.3	—	1.2	0.4	70.4	1.8	72.2
Scotland	3.4	38.8	—	1.4	0.7	42.3	2.0	44.3
Staffs., Shrops., Worcs. and Warwick	—	17.0	—	1.2	0.8	17.1	1.9	19.0
South Wales and Monmouthshire	4.2	74.0	5.2 (basic)	1.1	0.1	83.9	0.7	84.6
Sheffield (incl. small quantity in Manchester)	8.9	28.5	—	9.1	0.6	45.0	2.1	47.1
North-West Coast	—	1.4	5.3 (Acid)	0.5	0.1	7.2	0.1	7.3
Total	20.8	295.7	19.2	17.9	3.7	346.3	11.0	357.3
January, 1954	19.3	298.6	20.9	17.9	3.6	349.7	10.6	360.3
February, 1953	24.9	282.1	22.1	19.5	3.8	340.8	11.6	352.4

TABLE III.—*Weekly Average Deliveries of New Non-alloy and Alloy Finished Steel.*

Product.	1952.[3]	1953.	1953. Jan.	1953. Dec.[4]	1954. Jan.
Non-alloy steel:					
Ingots, blooms, billets and slabs[5]	4.5	4.7	5.3	4.2	5.0
Heavy rails	8.0	8.7	8.8	8.8	10.1
Sleepers, fishplates, etc.	1.8	2.2	2.8	1.7	1.0
Plates, ¼ in. thick and over	41.4	46.5	47.0	48.9	49.0
Other heavy prod.	39.0	43.9	46.5	42.8	49.2
Rods, bars in coil	15.9	15.6	18.2	16.5	19.0
Light rolled prod.	46.0	49.3	53.3	41.6	46.5
Bright steel bars	6.5	6.7	7.8	5.7	6.3
Hot-rolled strip	18.8	18.8	20.5	19.6	21.5
Cold-rolled strip	6.1	5.2	6.0	5.7	6.6
Sheets, incl. coated	31.6	33.4	35.0	34.2	35.9
Tinplate, terneplate and blackplate	16.0	14.9	14.7	15.4	16.2
Steel tubes, pipes	20.1	20.1	20.7	19.2	18.8
Tube and pipe fittings	0.4	0.3	0.4	0.3	0.4
Mild wire	12.2	10.6	11.9	10.5	11.7
Hard wire	3.6	3.6	4.3	3.4	4.1
Tyres, wheels, axles	3.5	4.4	5.3	4.8	4.9
Forgings (excluding drop forgings)	2.8	3.1	3.3	2.7	2.9
Steel castings	4.2	4.0	4.2	4.3	4.1
Tool and magnet steel	0.3	0.3	0.4	0.3	0.3
Total	282.7	296.3	316.4	290.6	313.5
Alloy steel	13.7	13.9	16.4	12.5	14.0
Total deliveries from U.K. prod.[6]	296.4	310.2	332.8	303.1	327.5
Add: Imported finished steel	13.8	6.9	14·2	6.5	5.7
	310.2	317.1	347.0	309.6	333.2
Deduct: Intra-industry conversion[7]	60.2	57.5	69.7	54.9	59.3
Total deliveries of new material	250.0	259.6	277.3	254.7	273.9

TABLE IV.—*Weekly Average Production of Pig-iron and Ferro-alloys during February*, 1954.

District.	Furnaces in blast.	Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total.
Derby, Leics., Notts., Northants and Essex	26	—	15.5	24.9	1.3	—	41.7
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Cheshire; Yorkshire (incl. Sheffield, excl. N.E. Coast)	8	—	14.8	—	—	1.2	16.0
Lincolnshire	11	—	28.4	—	—	—	28.4
North-East Coast	25	4.3	49.8	—	—	1.3	55.4
Scotland	9	0.8	15.3	1.8	—	—	17.9
Staffs., Shrops., Worcs., and Warwick	9	—	7.7	1.6	—	—	9.3
S. Wales and Monmouthshire	9	4.8	30.9	—	—	—	35.7
North-West Coast	8	16.6	—	0.1	—	1.2	17.9
Total	105	26.5	162.4	28.4	1.3	3.7	222.3
January, 1954	105	27.6	167.8	29.4	1.1	3.7	229.6
February, 1953	105	25.8	151.1	31.6	1.0	4.0	213.5

[1] Weekly average of calendar month.

[2] Stocks at the end of the years and months.

[3] Average 53 weeks ended January 3, 1953, all tables.

[4] Five weeks, all tables.

[5] Other than for conversion into any other form of finished steel listed above.

[6] Includes finished steel produced in the U.K. from imported ingots and semi-finished steel.

[7] Material for conversion into other products also listed in this table.

How many? *50 to 60 moulds per hour*

How much? *Less than £600*

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The 'Shelmolda Duplus' is a compact and simple machine, automatic in action but with each stage of the shell moulding process under the operator's control. The size of plate is 24" x 16" and as the oven is constantly curing, the machine is very economical in operation. May we send you full particulars.

We will gladly show you this machine at work in our foundry

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236/59

Raw Material Markets

Iron and Steel

The suspension of the production of castings over Easter has not brought any serious difficulties to users, as deliveries are generally up to date. Many foundries are anxious to obtain additional forward bookings, as the orders are completed readily, and continuous efforts, against keen competition, have to be made to secure sufficient work to keep plant in production. Mechanization and extensions to plant demand a much larger volume of business than formerly, and many units are finding it difficult to obtain the desired amount of business.

The light and textile foundries and some of the jobbing foundries find that orders which are now arising provide insufficient tonnage to keep production near capacity levels. Some improvement in demand for light castings for domestic equipment was seen earlier in the year, but it has not been maintained, with the result that short-time working is again being experienced.

Deliveries of high-phosphorus pig-iron have recently been at a reduced level. Producers have arrears of orders which were booked some weeks ago, when deliveries were delayed because of bad weather, which restricted output, and the supply of inferior ores is also curtailing the production of pig-iron to normal analyses.

The orders now being placed for this grade of pig-iron appear to be on a reduced scale, in consequence of the slackening in demand for castings.

The engineering and speciality foundries continue to be fairly well employed, although not excessively. They are using up all the low- and medium-phosphorus irons they can secure, and many English users find it necessary to pay the extra for Scottish foundry iron. Because these grades are in short supply, more hematite and refined iron is being utilized.

The foundries are adequately provided with foundry and furnace coke, and little difficulty is experienced in securing the necessary supplies of ganister, limestone, and firebricks.

There is no change in the fortunes of the re-rollers; unfortunately, it is only possible to record a continuance of short-time working and general depression in trade. Home business for small bars and light sections is not nearly sufficient to enable them to show any improvement in outputs. Price levels are unremunerative, and this, coupled with the present costs of conversion and raw materials, and the increased charges necessitated by short-time and interrupted working, are resulting in serious difficulties for many establishments.

Despite the slight slackening off in the tonnage of orders for heavy sections and joists, production continues to be maintained at a high level, and if this continues the position regarding supply and demand will eventually reach a more realistic basis. Consumers have apparently replenished their stocks, with the result that only urgent needs are being specified, principally for those sizes in popular demand and for which makers are heavily committed for some time ahead.

The picture in regard to plates, particularly the lighter thicknesses, is that while the demand is coming more into line with production, makers still carry heavy order-books, which will ensure full production for some considerable time ahead. Sheets continue to be in heavy demand.

Non-ferrous Metals

The tremendous burst of strength which ushered in last week on the Metal Exchange was followed by a relapse in values and, with the exception of copper and the forward price of tin, the close at midday last Thursday showed net losses in comparison with the quotations ruling on the previous Friday afternoon. In the United States the Custom smelters put up their selling price by 25 points to 30 cents, at which figure they came level with the producers. Export quotations, too, were higher. Lead advanced by ¼ cent to 14 cents, which is equal to about £112 and looks somewhat dear beside the London price of £92 10s. Market sentiment across the Atlantic was much encouraged by the trend on this side and the U.S. Government's recent announcement about stockpiling plans has helped considerably. Although tin lost ground, the position in the States is still strong, for it is thought that this year America will probably stockpile some 20,000 tons of Indonesian tin and possibly 12,000 tons of Bolivian. Moreover, there is now a better prospect that the tin restriction scheme will go through. Demand in the States for the non-ferrous metals seems to be reasonably good and the outlook is not unfavourable.

Following a turnover of some 2,400 tons on the first day of the week, trading in copper was quieter and the quotation fell away to close finally with a gain of £1 in cash and of 30s. in three months. The backwardation stood at £10. Zinc was surprisingly active, with a good turnover, and the backwardation narrowed to 10s., April losing 5s. on balance, while July gained 5s. At the close the price was £2 below the best level seen during the week. Lead, too, lost ground after climbing to £97 10s. April and £91 5s. July. In tin, trading was fairly active and closed 10s. and 15s. lower on balance at £93 10s. and a satisfactory development was a reduction to £10 in the backwardation. On balance, cash lost £10, but three months improved by £8 10s.

Official metal prices were as follow:—

COPPER, Standard—*Cash*: April 14, £245 to £245 10s.; April 15, £242 to £242 10s.; April 20, £244 10s. to £245; April 21, £246 to £246 10s.

Three Months: April 14, £233 to £233 10s.; April 15, £232 to £232 10s.; April 20, £233 10s. to £234; April 21, £233 15s. to £234 10s.

TIN, Standard—*Cash*: April 14, £760 to £765; April 15, £755 to £757 10s.; April 20, £750 to £752 10s.; April 21, £735 to £737 10s.

Three Months: April 14, £740 to £742 10s.; April 15, £745 to £747 10s.; April 20, £741 to £742 10s.; April 21, £730 to £732 10s.

ZINC—*April*: April 14, £78 15s. to £79; April 15, £79 to £79 5s.; April 20, £79 15s. to £80; April 21, £79 15s. to £80.

July: April 14, £78 5s. to £78 7s. 6d.; April 15, £78 10s. to £78 15s.; April 20, £75 5s. to £79 10s.; April 21, £79 5s. to £79 10s.

LEAD—*April*: April 14, £93 5s. to £93 10s.; April 15, £93 5s. to £93 10s.; April 20, £93 to £93 10s.; April 21, £92 10s.

First half July: April 14, £91 to £91 5s.; April 15, £91 to £91 5s. *Second half July*: April 20, £91 10s. to £91 15s.; April 21, £90 10s. to £91.

THE MINISTRY OF MATERIALS announces that from last Saturday its selling prices for tungsten ores of standard 65 per cent. grade and ordinary quality will be increased as follow:—Wolframite, from 200s. to 210s. and scheelite from 195s. to 205s. per long ton unit delivered consumers' works.